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CYSTS OF THE JAWS; SAVING INVOLVED VITAL TEETH BY TUBE DRAINAGE*

EARLE H. THOMAS, M.D., D.D.S., LL.B., Chicago

A cyst in the maxilla or mandible is a cavity the walls of which are lined with epithelial cells. These cells secrete fluid which, as it accumulates, exerts pressure outward on the wall of the cyst. This expansive pressure against surrounding bone causes a gradual pressure absorption of bone, thus allowing the cyst cavity to enlarge. This enlargement takes place along the lines of least resistance and thus the cancellous internal structure of the bones of the jaw is usually absorbed over a large region before absorption of the hard cortical layer of bone takes place.

In thus expanding through the cancellous bone of the jaws, the cyst wall gradually envelops the roots of teeth with which it comes in contact.

The usual treatment of a cyst is a surgical operation, which has as its objective the complete removal of the cyst wall. One epithelial cell left in the bone, because of inadequate operation, may be the starting point of another cyst.

When the cyst wall comes in contact with or envelops the side of the root of a tooth, but not the apical region, a surgical operation can be performed by which the cyst wall is peeled from the root of the tooth. Granulation tissue, which subsequently fills the postoperative cavity in the bone, will

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Fig. 1.—Left: Infected cyst of the mandible extending from the left cuspid region to the right third molar region. Center: Four views with the tube in place. The tube was inserted through the top of the ridge in the bicuspid region and was covered by a partial denture. Right: Result after one year of treatment. The cyst is completely obliterated and has been replaced with normal cancellous bone. All teeth respond to vitality testing, a normal mental foramen has been rebuilt and there is no disturbance of function of the inferior dental nerve or its mental branch.

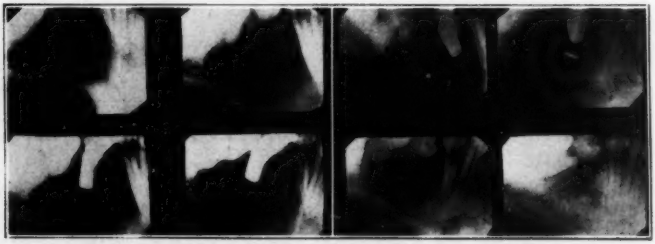


Fig. 2.—Left: Cyst of the mandible before and after the tube has been placed. Right: Upper left picture shows condition two months later; upper right, condition three months later; lower left, five months later and lower right, ten months later. All teeth are vital. There is no disturbance of the nerve.

usually grow to the root of this tooth, and the tooth, therefore, may be retained in a condition of health.

When the cyst wall has expanded to the extent of enveloping the apical region of a vital tooth, a surgical operation that peels the cyst membrane from this region will usually destroy the blood supply to the pulp of this tooth, thus requiring the removal of the tooth if a condition of health is to be maintained in the jaw. If the cyst membrane has enveloped the apical regions of several teeth, this type of surgical operation would result in the loss of all of the involved teeth.

Herein, I describe an operation and method of treatment of such a cyst that will eliminate the cyst without damaging involved vital teeth. This operation and method of treatment thus comply with that cardinal principle of the healing arts: "First of all, do no harm."

The procedure described herein is based on the principle that, given constant drainage, a cystic cavity will gradually diminish in size until,

Fig. 3.—Infected cyst involving almost the entire body of the mandible of a woman aged 83. The tube was inserted through the ridge in the anterior region and a lower denture was worn over it. After eight months of treatment the patient was in an auto accident and sustained fractures of the skull, arms and legs and the lower denture. The mandible remained intact.

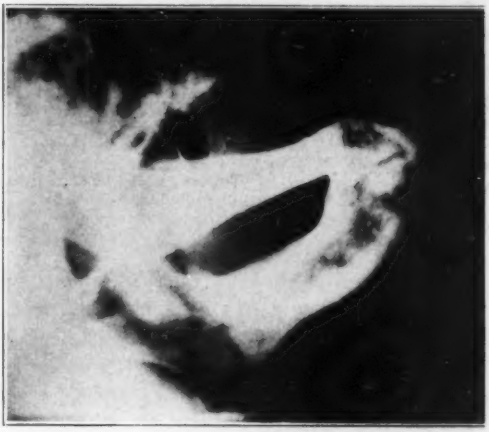


Fig. 4.—Result of one and one-half years of treatment of case shown in Figure 3. The cyst is completely obliterated. The bone has regenerated completely and there is no disturbance of function of either mandibular nerve.

eventually, the small remaining area of epithelial cystic cells at the point of constant drainage will merge with and become normal surface epithelium with usually normal surface contour.

As the cyst cavity diminishes in size and the cyst membrane contracts, the surrounding bone cells continuously proliferate next to the cyst membrane, and these bone cells become calcified in a few months and thus the normal cancellous internal structure of the jaw is restored (Fig. 1).

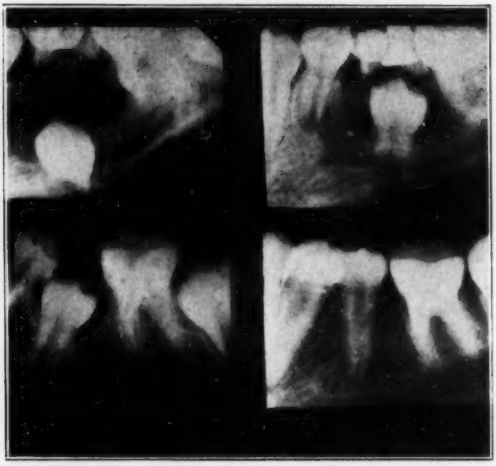


Fig. 5.—Dentigerous cyst in the mandible around the crown of the second bicuspid. Upper left: Roentgenographic appearance before operation. Upper right: The tube is shown in place. Note the remarkable development of the root and movement of the tooth over a period of two and one-half months. Lower left: Further progress is shown in the development and eruption of the tooth. Lower right: Condition one year after beginning of treatment. The root is fully developed and the bone has regenerated completely. This case was treated in 1931. Although I had formerly experimented with other means of continuous drainage, this was the first case handled by a metal tube and the first in which the patient could practically treat himself.

As the cyst cavity diminishes in size and the cyst membrane contracts, the portion of the membrane that was enveloping the roots of teeth gradually moves away from these roots and the intervening region is restored with normal bone structure. During this process of contraction of the cyst membrane and rebuilding of bone structure, there is no disturbance to the blood supply of vital teeth, nor is there any injury to the pericemental membrane. This membrane and its adjacent lamina dura are gradually restored to their normal anatomic relationship and function (Fig. 2).

There seems to be no limit to the size of a cyst that can be successfully treated by this method (Figs. 3 and 4). Roentgenograms will be shown of one case involving almost the entire body of the mandible and of one case involving almost the entire ramus and half of the body of the mandible. Roentgenograms will be shown also of a case in which a dentigerous cyst was eliminated and the involved tooth brought from the lower border of the mandible up to almost normal position in the mouth (Fig. 5).

Although, to the dentist, preservation, in a healthy condition, of the teeth involved in a cyst of the jaw would usually be the main factor in choosing

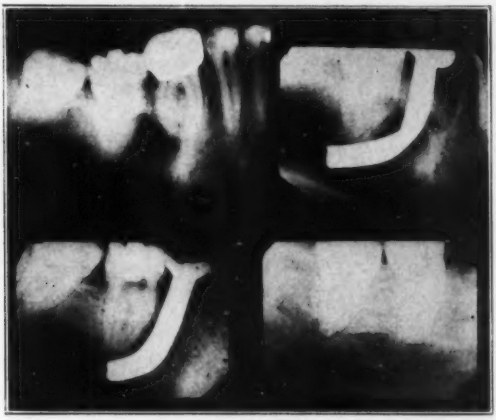


Fig. 6.—Upper left: Infected cyst of the mandible caused by a pulpless first molar. Right: The first molar has been removed and a tube inserted through the socket. This boy was going to college in a distant state and was instructed to keep the cavity irrigated and to shorten the tube after one month. Lower left: Roentgenographic appearance of the case when the patient returned three months later. Right: Appearance six months after operation. The cyst is obliterated and the region has filled with cancellous bone. The teeth are vital to testing and there is no disturbance of the inferior dental nerve.

this method of eliminating a cyst, there are other factors that may be equally important.

When a cyst of the mandible has involved the inferior dental nerve, this treatment will preserve the nerve and result in a rebuilding of a normal canal in the bone. There will not be even temporary paralysis or anesthesia of the region supplied by the nerve (Figs. 1, 2, 6 and 7).

When a cyst of the maxilla has involved the maxillary sinus, in which case an operation for surgical removal of the cyst membrane would almost invariably disturb the normal sinus membrane, with the usual sequelae, the method of treatment herein described should be the one of choice because it will cause no such complications and will obviate serious deformities of the upper jaw. The end-result of this treatment will be a normally contoured sinus with a normal relation of sinus membrane to bone and bone to soft tissues of the mouth (Fig. 8).

When a cyst has destroyed the cortical plate of bone and the cystic membrane is in contact with the soft tissues of the palate, lips or cheek, it is sometimes difficult to dissect the cyst membrane with the assurance that no cyst cells are left, to become the starting point of another cyst. The method of treatment herein described avoids this difficulty.

Briefly, the method of treatment advocated for eliminating a compli-

Fig. 7.—Upper left: Follicular cyst around crown of the impacted lower third molar involving the mandibular canal and the roots of the second and first molars. Right: The impacted molar has been removed and a tube placed on the buccal side of the second molar. Lower left: Roentgenographic appearance of the case four months later. Right: Appearance less than eight months later. The molars respond to vitality tests and there is no disturbance of nerve function.

Fig. 8.—Cyst extending deep into the maxillary sinus region. The wall of the sinus was markedly displaced but there was no communication between the cyst and the sinus. Above: Roentgenogram taken before operation. Lower left: The tube is shown in place. Right: The cyst is obliterated and the bone has regenerated in three months.

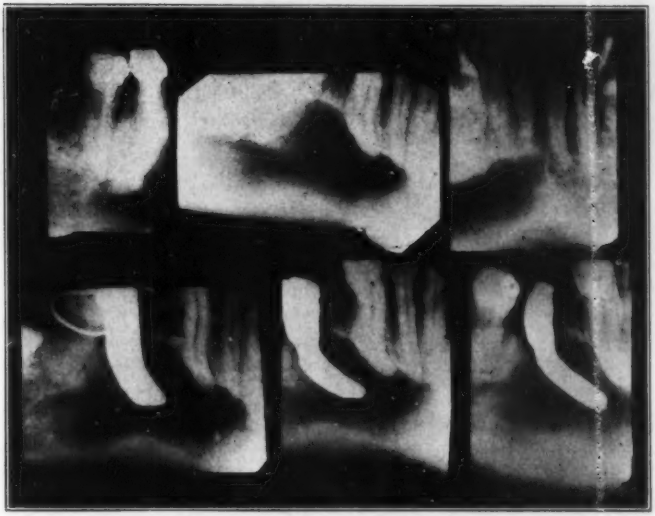


Fig. 9.—Upper: Infected cyst of the mandible caused by a pulpless first bicuspid. Lower left: Roentgenographic appearance one month after the tooth was removed and a tube inserted. Center and right: Appearance three months after operation.

cated type of cyst is surgical removal of sufficient tissue to leave a small opening from the mouth tissues into the interior of the cyst cavity and insertion through and retention in this opening of a metal tube through which there will be constant drainage.

The opening should be at the point of least depth to the cyst consistent with avoiding disturbance of dental structures and appliances, and avoiding irritation to the lips or cheeks by the outer end of the tube. The opening may be through the socket of a diseased tooth that has been extracted or, if the patient is wearing a removable denture, the opening may be made under this denture (Figs. 1, 9 and 10).

The tube may be cut from the tin nozzle that is attached to a large tube of socket paste. The tin is soft and can easily be contoured to any desired shape. The tube is expanded at the outside end so that it cannot be pushed entirely into the cyst cavity, and it is expanded slightly at the point of entry into the cyst cavity so that it cannot work out.

Sometimes, instead of enlarging the portion of the tube that is inside the cyst cavity, the tube is held in place by a loop of heavy wire attached to an adjacent tooth.

In some cases, a curve in the portion of the tube inside the cyst will prevent dislodgment of the tube.

The tube can be expanded at any level by inserting in its lumen a ball-

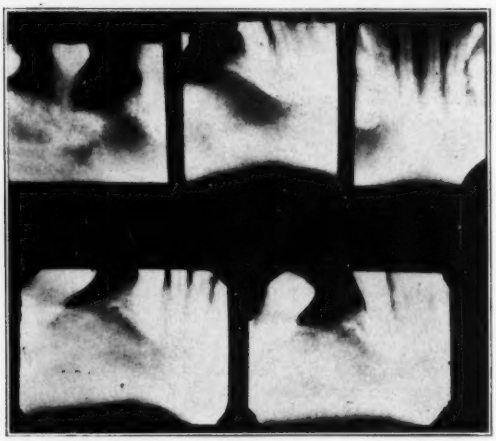


Fig. 10.—Roentgenographic appearance nine months after operation (above) and fourteen months after operation (below) of case shown in Figure 9. The bone has completely regenerated and all teeth respond to vitality tests.

ended instrument, the tip of which is pressed outward against the fingers or thumb while they hold the tube firmly on the outside.

Flattening the tube at a point just inside the cyst cavity is another method of expanding and thus locking it in place. This makes the tube oval and thus wider at this point than the diameter of the tube where it goes through the opening.

The outer end of the tube can be expanded by stretching its margins with a pair of pliers. One or two wings may be cut in the external margin and folded inward across the opening to help prevent ingress of food particles.

The expanded outer end of the tube should, of course, be adapted to the contour of the tissue surface around the opening. If the opening should be near the mucobuccal fold, obviously there should be no flange on the margin of the tube that is in contact with the soft tissues of the fold.

The tube should be removed every few days and cleaned and, at the same time, the cyst cavity should be irrigated. The fact that this can be done by the patient if desired makes the method ideal for the patient who, because of distance or transportation difficulties, would have difficulty in making a long series of office visits.

I might mention here that, instead of a hollow tube, a solid dumbbell-shaped metal drain may give sufficient drainage along its sides. Solid metal, if used, should be removed and reinserted more frequently than is necessary with the hollow tube (Fig. 8).

The method of tube drainage described here may be continued until the cyst is entirely eliminated. Use of the tube can be discontinued when the cyst cavity has been reduced to the size of the inner end of the tube.

When it is advisable to shorten the period of attention, tube drainage may be maintained only a sufficient time to allow the cyst wall to contract a safe distance from important structures. As soon as this has been accomplished, an operation may be performed for removal of the cyst membrane. —*55 East Washington Street.*

(Two important considerations in the treatment of odontogenic cysts of the jaws must be kept in mind when tube drainage or Partsch operations are undertaken. Dentigerous cysts are potential ameloblastomas and a sufficient amount of cyst wall should be removed for microscopic diagnosis. Surgical enlargement of the oral opening may become necessary to maintain adequate drainage until sufficient cyst wall contraction towards the surface has taken place. Editor.)

AMERICAN SOCIETY FOR ADVANCEMENT OF GENERAL ANESTHESIA IN DENTISTRY

The profession is cordially invited to attend the Spring Meeting of the American Society for the Advancement of General Anesthesia in Dentistry at the Hotel New Yorker, Thirty-Fourth Street and Eighth Avenue, New York City, on Monday evening, March 25, at 8:15. A pre-meeting dinner will be held at the hotel at 7 o'clock.

The scientific program will be devoted to a discussion of the physiology of respiration with special relationship to anesthesia.— *M. Hillel Feldman, Executive Secretary.*

MULTIPLE FRACTURES OF THE FACIAL BONES: REPORT OF CASE

DONALD T. WAGGENER,* D.D.S., Lincoln, Neb.

Injuries to the face, including fractures of all the facial bones, are not uncommon in modern warfare. Treatment of these injuries must be based on a systematic and orderly plan of therapy, aimed at reduction of the fractures, re-establishment of the functions of the jaws and restoration of the facial contours. This can best be accomplished by close collaboration of the oral surgeon, the plastic surgeon and the otolaryngologist.

Severe facial injuries are frequently associated with fracture of the ethmoid bone, resulting in cerebrospinal rhinorrhea. If this type of injury is present, any manipulation of the bony structures of the face should be delayed for ten to fourteen days, during which time enough fibrous tissue can form to wall off the defect in the ethmoid bone. Earlier manipulation of the bony fragments might disturb the fracture of the ethmoid bone and invite infection of the meninges from the adjacent nasal cavity.

During this waiting period, one of the sulfonamides or penicillin should be administered as an aid in the prevention of meningitis. Injuries to the soft tissues of the face and to other portions of the body can be treated; teeth involved in the fractures can be removed; roentgenograms made of the teeth and facial bones; compound or colloidal impressions of the dental arches and plaster study casts prepared; and a detailed plan of treatment can be formulated. The cast of either the lower or the upper jaw should duplicate the complete and original contour of the dental arch. Duplicate casts are cut at the sites of the fractures and mounted on an articulator in such a manner as to restore the proper contour of both arches and the occlusion of the teeth.

The case reported here illustrates some of the problems encountered in the care of multiple fractures of the facial bones together with the organized treatment that was employed.

REPORT OF CASE

History.—The pilot of a bomber, who had sustained a severe crushing injury to his face and head in a plane crash ninety minutes earlier, was admitted to the hospital. He was in moderate shock, unconscious and vomiting large quantities of blood. Morphine sulfate ¼ grain had been administered thirty minutes after the injury. Immediately after admission, 1,750 cc. of plasma was given, and two hours later 500 cc. of whole blood was administered. Neurologic examination on admission was roughly normal.

*Major (DC) AUS.

Fig. 1.—Lateral roentgenogram of the face, showing depressed fragments of the left mandible and fractures of the maxilla.

Examination.—Clinical examination revealed multiple contusions and lacerations of the chin and left cheek and severe upper facial lacerations with a comminuted displaced fracture of the left side of the maxilla. There was severe depression of the left malar bone and downward displacement of the inferior margin of the orbit which hung loosely. The lateral wall of the orbit was displaced laterally and both the inner and outer canthi of the left eye were torn completely and separated widely by the deep lacerations. There were severe lacerations of the forehead and occiput, a huge hematoma of the left side of the face, fractures of the mandible and a fracture at the base of the skull, manifested by blood and cerebrospinal fluid draining from the left ear. All lacerations were contaminated with small pieces of plastic glass and green paint.

Treatment.—The wounds were debrided, a Penrose drain was inserted into the contused tissue of the left cheek and the edges of the skin were brought together loosely with sutures. No attempt was made to reduce the fractured bones. The patient was given 1 cc. of tetanus toxoid, and the administration of penicillin was begun.

Course.—The patient regained consciousness in twenty-four hours. His pain was controlled by codeine sulfate and his restlessness by phenobarbital. Fluids were given subcutaneously for the first three days. On the fourth day,

Fig. 2.—Roentgenogram showing comminuted fracture of the coronoid process and zygomatic arch and displacement of the lower left third molar.

the patient was able to take fluids by mouth. Five days after the injury, the drain and all sutures were removed from the face. Penicillin was discontinued on the sixth day, after the patient had received a total of 900,000 Oxford units.

Ophthalmological Examination.—By the fourth day the right eye was normal. The left eye exhibited complete ptosis of the lids, and the outer canthus was 2½ cm. inferior to its normal position. The left eyeball was contused and the eye was blind.

Roentgenographic Examination.—Examination made one week after the injury revealed a simple fracture of the right condylar neck of the mandible, two compound fractures of the body of the left mandible with depression of the fragments and comminuted fracture of the left coronoid process of the mandible (Figs. 1 and 2). There was a compound comminuted depressed left maxillary fracture, involving the lower margin of the orbit and the hard palate, a simple fracture of the alveolar process of the right maxilla and a compound comminuted depressed fracture of the frontal process and body of the left malar bone (Fig. 3). The lower left third molar was displaced medially and posteriorly from its normal position so that it was situated in the soft tissues near the left tonsil (Fig. 2). Because of the poor condition of the patient and the difficulties which would be encountered, it was decided not to remove the tooth until the other injuries had been treated.

Treatment.—On the twelfth day it was felt that it was safe to begin treat-

Fig. 3.—Postero-anterior roentgenogram of the face taken in the Water's position, showing fracture of the left malar bone with the fragments depressed.

ment of the fractures. The fragments of the maxilla were manipulated so that an impression of the upper dental arch, revealing the complete and original contour, could be secured. Sectional impressions of the lower dental arch were obtained. Plaster casts were made and mounted on an articulator in proper occlusal relationship. A cast silver bite splint was then constructed, which covered the occlusal, incisal and lingual surfaces of the teeth. Multiple perforations were made in the outer edge of the splint for the attachment of wires. Segments of hooked arch bars were wired to the teeth of each fragment of the upper and lower jaws. The lower left lateral incisor, which was in the line of fracture, was removed under local anesthesia and the cast silver splint was inserted into the mouth. The fragments of the upper jaw were manipulated so that the upper teeth fitted into the silver bite splint, which was wired to the upper hooked arch bar. These procedures immobilized the upper dental arch in proper alinement. Intermaxillary elastic traction was applied between the hooked arch bars of the upper and lower jaws.

Course.—Within thirty-six hours, the fragments of the mandible had been pulled up into their proper positions by the elastic traction so that the teeth of the lower jaw also fitted into proper position in the silver bite splint (Fig. 4).

Fistulous tracts began to appear in the tissue of the left cheek about the fifteenth day. During the next four days 400,000 Oxford units of penicillin was administered. Three weeks after the injury it became evident that portions of the lateral wall of the left orbit were going to sequestrate, and from time

Fig. 4.—Roentgenogram of the face, showing arch bars, silver splint and traction wires in position.

to time during the course of treatment small spicules of bone were removed from the fistulous tracts.

Treatment.—Twenty days after the injury a plaster head cast was constructed. Incorporated in it was the type of metal head band, designed by Erich and Austin,[1] with projecting posts for the attachment of a bar on each side of which was a sliding adjustable hook with a turnbuckle attached (Fig. 5). On the next day, the intermaxillary elastics were removed and four procedures were carried out under gas-oxygen-ether anesthesia, intratracheally administered. (1) A traction wire was inserted into the left mandibular angle to pull the ascending ramus, which was displaced medially and anteriorly, into its proper position (Fig. 4) after Darcisac's method. This wire was attached by elastics to a hook emerging from the head cast in the left mastoid region. (2) The comminuted left malar bone, which was depressed 2½ cm., was mobilized and elevated through an oral-antral window. A Penrose drain was inserted into the antral cavity which was then packed tightly with iodoform gauze to immobilize the fragments of the left malar bone. However, because of the extensive comminution of the left maxilla, the malar bone could not be maintained in its proper position by this method alone, necessitating a third procedure. (3) Through a small incision, an external fixation pin was inserted into the body of the comminuted left malar bone. The pin was fastened to the bar on the head cast by means of pin clamps and a fixation rod which held the malar bone in its proper position (Fig. 6). (4) A stainless steel wire was inserted through the left

1. Erich, J. B. and Austin, L. T.: *Traumatic Injuries of Facial Bones.* Philadelphia and London: W. B. Saunders Company, 1944.

Fig. 5.—Metal head band with silver splint, traction wires and external fixation pin attached.

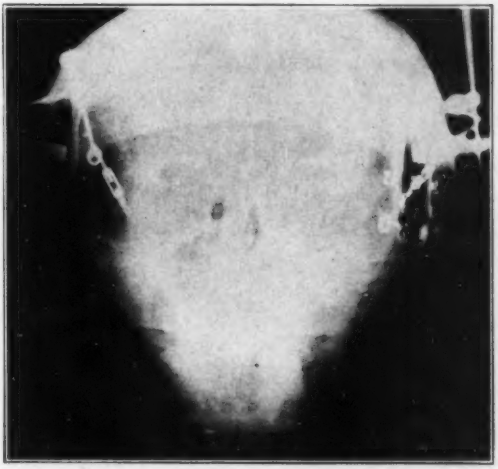


Fig. 6.—Roentgenogram of the head, showing head band with attachments in position.

cheek by means of a straight needle. This traction wire was fastened through one of the perforations on the left side of the silver bite splint, after the method of Federspiel. The upper end of the traction wire was then attached by elastics to the turnbuckle on the adjustable hook. Another traction wire was passed through the right cheek and attached to the silver bite splint and to the turnbuckle on the right side in the same manner (Fig. 6). The hooks on the head cast were adjusted to prevent lateral pull by the traction wires on the soft tissues of the cheek.

Outcome.—The day after these procedures were carried out the inter-

maxillary elastics were again applied. By the third day the elevation and immobilization of the upper jaw were completed. The elastics, connecting the turnbuckle and the traction wires through the cheek, were replaced with wires. The turnbuckles permitted the changing of tension on the traction wires.

After four weeks of immobilization of the fractured bones, all the traction wires, the intermaxillary elastics, the hooked arch bars and the pin in the left malar bone were removed. By the end of another week the jaws functioned well enough to permit the patient to eat soft foods. The patient was evacuated to the United States fifty-four days after the injury. Plastic procedures will be necessary to restore the contour of his face completely.

SUMMARY

A case of multiple fractures of the facial bones, complicated by other injuries, has been presented. Emphasis has been placed on the part the oral surgeon plays in the treatment of such injuries. The appliances used for the reduction and immobilization of the fractured bones and the re-establishment of jaw function have been described.—*800 South Thirteenth Street.*

AMERICAN BOARD OF ORAL SURGEONS

Examinations for certification by the American Board of Oral Surgeons will be held at Boston, July 29 and 30, 1947, and at Chicago, November 7 and 8, 1947.

For information, write to Dr. Leslie M. FitzGerald, Secretary, 718 Roshek Building, Dubuque, Iowa.

SULFADIAZINE REACTIONS: REPORT OF THREE CASES*

C. Richard Miller, D.D.S., Harrisburg, Pa.

CASE I

History.—A white man, aged 25, was admitted to the hospital on January 23 with a diagnosis of dermatitis medicamentosa. During the fifteen days past, the patient had received a daily dose of sulfadiazine 1 gm. as part of the mass chemotherapy program of the Naval Training Station. One day before admission he developed a cold and fever and reported to sick bay.

Physical Examination.—The patient was acutely ill, complaining of moderate respiratory distress and mild cyanosis. The temperature was 102.2°; the pulse 132; and the respiration 25.

The skin was dusky and reddish and a diffuse vesicular rash, interposed with bullae varying in size from a pinhead to a dime, was distributed over face, trunk and extremities. There were many small bullae at the mucocutaneous border of the mouth (Fig. 1). The eyes showed a marked injection of the conjunctivae. The lids were crusted and pustular. The external auditory canals were covered with vesicular blebs. The mucous membrane of the nose was inflamed and bullae were present in the vestibules. A friable, grayish membrane covered the soft palate and tonsillar faucae and the lips were swollen and edamatous. Bullae were present at the mucocutaneous borders. The buccal mucosa and the tongue were highly inflamed and covered with

Fig. 1.—Distribution of the rash and bullae is shown.

*From the U. S. Naval Hospital, Sampson, N. Y.

bullae. The general appearance of the mouth was that of an ulcerated slough.

An examination of the chest disclosed loud rhonchi throughout both lungs. The heart was negative. The abdomen and genitalia were negative and the reflexes were normal.

Laboratory Examination.—The blood level for sulfadiazine was 2 mg. per 100 cc.; red blood cells 4,210,000; white blood cells 10,850; hemoglobin 11 gm.; total protein 7.55 gm. per 100 cc. of serum; nonprotein nitrogen 51 mg.; and urea nitrogen 18 mg.

Urinalysis disclosed a clear specimen with a specific gravity of 1.015 and a sulfadiazine level of 0.9 mg. per 100 cc. The urine was negative for albumin and sugar.

Treatment and Course.—The patient was given 1,000 cc. of 5 per cent dextrose in physiologic salt solution and a transfusion of 500 cc. of citrated whole blood. His mouth was treated with a local application of 1 per cent aqueous solution of gentian violet.

On the day after admission the patient's temperature was 105.5°. Diagnosis was changed by reason of concurrence to bronchopneumonia and the patient was given 20,000 units of penicillin every four hours. Total protein had dropped to 5.4 gm. per 100 cc. Nonprotein nitrogen was 30 mg.; and urea nitrogen was 15 mg.

On the fourth day of illness, the patient was generally unimproved. The total protein reading was 6.25 mg.; albumin showed 3.95; and globulin 2.30.

Another transfusion of 500 cc. of citrated whole blood was given and periodic aspiration of the mouth and pharynx with a suction apparatus was begun. Because of increased respiratory difficulty, oxygen was instituted. The patient continued to have a stormy febrile course, the temperature ranging between 101° and 103° for twenty-one days. He was kept in the oxygen tent and was given 20,000 units of penicillin intramuscularly every four hours, with periodic transfusions of citrated whole blood and 5 per cent dextrose in physiologic salt solution. The 1 per cent aqueous solution of gentian violet and a mouth wash of aluminum hydroxide gave the patient some relief. He had extreme difficulty in eating or drinking.

Roentgenographic Examination.—The report on roentgenograms of the chest read: "There is a widespread disseminated, exfoliative and exudative bronchitis in both lungs, more concentrated in the right base posteriorly."

A follow-up roentgenogram on March 8 revealed: "The process in the right base has improved considerably but resolution is not complete."

Outcome.—The skin lesions healed slowly and the conjunctivae cleared. By March 13 the condition of the mouth was greatly improved and the patient was able to take a normal soft diet. By April 1 all skin lesions had healed without scarring but they left some slight purplish discoloration. The patient was discharged within several weeks to limited duty.

Final Diagnosis.—Dermatitis medicamentosa and bronchopneumonia.

CASE 2

History.—A young white man was admitted to the hospital with a diagnosis of dermatitis medicamentosa. The day of admission he had had sulfadiazine

Fig. 2.—Inflammation and bullae at the mucocutaneous border and mucous membrane of the mouth are shown.

7½ grains at the Naval Training Station. Within several hours he manifested reaction to the drug. He gave a history of having experienced a reaction to sulfonamide administration several months before coming into the service. At that time he had been hospitalized for several months.

Physical Examination.—The temperature was 101.1°; the pulse 102; and respiration 23. The patient's entire body was flushed and a diffuse vesicular rash interposed with bullae covered most of the body. These bullae varied in size from a pin point to a quarter. They were markedly tender.

The eyes showed a marked conjunctivitis and there were bullae on the outside of the nose and ears. The mucous membrane of the mouth was highly inflamed and there were small bullae throughout, especially pronounced at the mucocutaneous border (Fig. 2). Heart and lungs were negative and reflexes were normal.

Laboratory Examination.—The blood level for sulfadiazine was 3 mg. per 100 cc.; red blood cells 4,560,000; white blood cells 7,500; and hemoglobin 12 gm.

Urinalysis disclosed a clear specimen with a specific gravity of 1.025. The urine was negative for albumin and sugar.

Treatment and Course.—The patient was given 1,000 cc. of 5 per cent dextrose in physiologic salt solution and a transfusion of 500 cc. of citrated whole blood on the day of admission. He was very listless, his only complaint being the soreness of the bullae. He was given a soft diet and vitamins by mouth. For about five days his condition remained unchanged. The bullae then began to regress. After two additional weeks of hospitalization the patient was discharged to duty.

Comment.—Most of the drug reactions developed after a lag period of about two weeks. A few patients with severe drug reactions appeared to have sulfadiazine fixed in the tissues as evidenced by recovery of the drug from bullae in the skin and in large amounts from the blood and urine several days after ingestion of the last dose.

Although the mechanism of these untoward reactions is unknown, the present observations suggest that these patients have a drug idiosyncrasy and

Fig. 3.—Condition of the patient's mouth before and after treatment.

that they manifest sensitization whether sulfadiazine or some other sulfonamide is administered.

CASE 3

History.—The patient was referred to the dental department from one of the hospital wards with a diagnosis of herpes labialis. Examination of the patient's health records showed that he had undergone a prophylactic course of sulfadiazine six weeks before admittance to the hospital. According to the case history, no sulfonamide had been administered while the patient was in the hospital. His blood count was within normal limits and his sulfadiazine level was negative.

Treatment and Course.—The patient was treated with a 1 per cent solution of gentian violet once a day for three days and a mouth wash of bicarbonate of soda every four hours.

On the third day of treatment the patient brought in a lipstick which he had purchased for chapped lips. Chemical analysis showed that the stick contained a 5 per cent sulfonamide ointment. Gentian violet and mouth wash were continued for approximately one week. Figure 3 shows the progress made over a ten-day period. The patient was discharged to duty after the third week.

Comment.—This case shows the small amount of the drug necessary to produce a reaction in persons sensitive to the sulfonamides.

Final Diagnosis.—Dermatitis medicamentosa.

SUMMARY AND CONCLUSONS

1. Sulfadiazine 1 gm. daily was administered prophylactically to 65,000 personnel at this Naval Training Station from December 1, 1943, to April 1, 1944.

2. The incidence of all bacterial respiratory tract diseases, particularly streptococcal infections, was significantly reduced.

3. There were fifteen severe reactions but no deaths. About 25 per cent of the group had mild dermal reactions.

4. This program was discontinued because it produced sensitivity to sulfadiazine in too many men, which it was felt might handicap the patient at some future date should sulfonamide therapy be indicated in a serious disease.

5. The mucous membrane of the mouth and the conjunctivae were usually the first parts to be affected.

6. These cases have been presented to show that this sensitization might appear during some minor treatment in or about the mouth.

7. Dentists should know the possible dangers of administering the sulfonamides either locally or by mouth.—*1400 North Second Street.*

CELLULITIS OF THE FACE COMPLICATED BY BRAIN ABSCESS: REPORT OF CASE

C. Richard Miller, D.D.S., Harrisburg, Pa.

History.—A white man, aged 25, was admitted to the hospital on June 19 with a diagnosis of cellulitis of the upper jaw on the left side. The patient had a ruddy complexion and weighed 134 pounds. His upper left third molar had been extracted eight days before admission and his face had been swollen for five days.

Oral Examination.—There was tenderness and swelling of the left side of the upper jaw (Fig. 1) and acute gingivitis. Roentgenographic examination of the maxilla and mandible was essentially negative. The temperature was 100°; the pulse 80; and the respiration 20.

Treatment and Course.—The patient was given sulfathiazole 1 gm. every four hours. An ice bag was applied to the face and a mouth wash was prescribed. His condition improved very slowly although he had no appetite and was very listless. Sulfathiazole was discontinued and the patient was given a diet high in vitamins and calories as well as injections of vitamin C. He complained of dull headaches and slight pain in the parietal area. He was kept comfortable with sedatives.

On July 9, twenty days after admission, the patient's temperature rose to 101°. He complained of extensive pain over the left parietal area, left cheek and ear, lasting for three days. At this time the patient had an epileptiform seizure. During the same day, he had four short convulsions, lasting about two minutes each.

Medical Consultation.—During consultation on July 9, the patient exhibited uniformly bilateral clonic contractions and muscle rigidity. There was a foul oral discharge prior to each convulsion. A diagnosis of acute cerebrospinal meningitis was made.

Laboratory Examination.—The spinal fluid was turbid and showed: white blood cells 4,300; segmented neutrophils 86 per cent; lymphocytes 14 per cent; protein 106.6 mg. per cent; and sugar 58 mg. per cent. There was increased pressure. A smear was negative.

Fig. 1.—Appearance of patient at time of admission to the hospital.

Treatment and Course.—The patient was given 20,000 units of penicillin intramuscularly every three hours. On the next day (July 10) there was no disturbance of central speech function, cranial nerve innervations, gross coordination, sensation or motor function. Restlessness and slight confusion with marked muscle rigidity were present. The reaction to a test for Brudzinski's sign was positive. The patient's temperature was 103°. Diagnosis of possible brain abscess was made but at this time no localizing signs were present. The spinal fluid was turbid and showed: total proteins 53.2 mg. per cent; sugar 56 mg. per cent; and a pressure of 340 mm. of water.

July 11. The patient seemed improved and was given 22,000 units of penicillin intrathecally as well as intramuscular doses of 20,000 units every three hours.

July 12. The condition was unchanged. The patient was receiving a daily intrathecal injection of 20,000 units of penicillin and intramuscular injections of 20,000 units every three hours. The spinal fluid was less turbid and the lowered count showed: white blood cells, 1,725; segmented neutrophils 66 per cent; lymphocytes 34 per cent; total proteins 80.8 mg. per cent; and sugar 73.3 mg. per cent. A smear was negative.

July 14. The patient's improvement continued. The spinal fluid was less turbid and showed: white blood cells 850; polymorphonuclear leucocytes 72 per cent; and lymphocytes 28 per cent. A smear was negative.

July 15. The patient was sufficiently improved to sit up and read. Examination of spinal fluid showed 79.9 mg. per cent total proteins and 68 mg. per cent sugar.

July 17. The patient's temperature had gone no higher than 99.3° during the past forty-eight hours. There was continued improvement and complete absence of meningeal irritation. Administration of penicillin was discontinued.

July 18. A roentgenographic study of the cranium was negative.

July 26. Except for an increasing but slight headache and loss of weight, the patient's condition had been fair until this date when he suddenly became disorientated and suffered a convulsive seizure. His temperature began to rise and administration of penicillin was resumed.

July 27. The patient was completely disorientated and the convulsive seizures were repeated. The temperature continued to rise. Paralysis of the right side of the face seemed to have developed. Neurological examination revealed the possibility of basilar meningitis or brain abscess. The patient was given 30,000 units of penicillin intramuscularly every three hours after one dose of 50,000 units intravenously.

July 28. The patient had been unconscious for most of the past twenty-four hours. The morning temperature reading by axilla was 108°. The patient died the morning of the twenty-eighth.

Summary and Findings at Autopsy.—The patient, a white man, aged 25, was admitted to the hospital with cellulitis of the jaw and face resulting from a tooth extraction. Clinical evidence of irritation of the trigeminal nerve on the left side developed later and the patient subsequently showed evidence of meningitis with a spinal fluid cell count as high as 4,300 white blood cells per cubic millimeter. However, no organisms were ever detected on direct smear or on attempts at aerobic culture. At autopsy, three separate brain abscesses were found in the left cerebral hemisphere, thereby confirming the final diagnosis of brain abscess. Failure to recover organisms from the spinal fluid on culture is explained by the fact that the organisms proved to be anaerobic. The actual mechanical cause of death was the excessive degree of cerebral edema.—*1400 North Second Street.*

LUDWIG'S ANGINA WITH OVERWHELMING WIDESPREAD SEPSIS: REPORT OF CASE

C. Richard Miller, D.D.S., Harrisburg, Pa.

History.—The patient, aged 23, a well-nourished, well-developed man of Italian descent, was admitted to the hospital on July 27 with a diagnosis of Ludwig's angina. On July 17 the lower left third molar had been extracted with no apparent ill effect. The lower right third molar had been extracted on July 25, after which the patient had complained of pain and swelling in his jaw. On the evening of July 25, elevation of temperature had been noted. An ice bag to the jaw and 10 grains of aspirin had been prescribed. On the next day the patient's temperature had risen and sulfathiazole 3 gm. had been given by mouth, followed by 1 gm. every four hours.

Oral Examination.—At the time of admission, the patient was unable to talk clearly and appeared to be acutely ill. He was very nauseated and there was extensive swelling of the neck and floor of the mouth. The tongue was pushed to the roof of the mouth by the swelling in the sublingual region. There was a slight amount of bleeding in the area from which the more recent extraction had been made. The temperature was 104.2°; the pulse 120; and the respiration 22.

Laboratory Examination.—On the day of admission the following findings were recorded: white blood cells 16,800; red blood cells 6,130,000; hemo-

globin 75 per cent; monocytes 2; lymphocytes 14; segmented neutrophils 77; and band form neutrophils 7.

Treatment and Course.—On the morning of admission the patient was given sulfadiazine 5 gm. intravenously in 500 cc. of physiologic salt solution followed by 1,500 cc. of physiologic salt solution with 5 per cent glucose. At 1 p. m., 50,000 units of penicillin and sulfadiazine 5 gm. were given intravenously in 1,000 cc. of physiologic salt solution. The patient was placed in an oxygen tent and listed among the hospital's serious cases.

Later that evening the patient appeared to be slightly improved. His airway was free, he was breathing more easily and was fairly comfortable under the oxygen tent. During the night he became partially irrational and was given ¼ grain of morphine and 25,000 units of penicillin intramuscularly. The next morning, sulfadiazine 5 gm. was administered and 25,000 units of penicillin in 1,000 cc. of physiologic salt solution was given intravenously, followed by intramuscular injection of 25,000 units of penicillin every three hours. The patient's temperature remained at about 104.5°.

Laboratory Examination.—On the day after admission the following findings were recorded: white blood cells 14,800; red blood cells 4,510,000; hemoglobin 80 per cent; monocytes 1; lymphocytes 17; segmented neutrophils 73; band form neutrophils 8; and juvenile neutrophils 1.

Urinalysis revealed cloudy orange-colored urine with acid reaction and specific gravity of 1.021. The specimen was negative for sugar and positive (1+) for albumin. Microscopic examination showed a few pus cells with occasional cylindroids. The sulfa level was 8 mg. per cent.

Medical Consultation.—On July 28, at 1 p. m., medical consultation was called. Restriction of the patient's airway was greater, owing to the increase in swelling. It was felt advisable to perform tracheotomy, which was scheduled for 4:30 p. m. The patient's temperature rose to 105°, his pulse rate increased steadily, his respiration became more labored and he was very irrational. He died suddenly at 4 p. m. as he was being prepared to be taken to the operating room.

Summary and Findings at Autopsy.—The patient, a man aged 23, had his lower right third molar extracted two days before admission to the hospital. On that evening, his temperature rose and he developed a swelling of the neck and a lump on the floor of the mouth. He was admitted with a diagnosis of Ludwig's angina. At the time of admission he had extreme difficulty in swallowing and speaking. He later showed respiratory difficulty and it was decided to perform tracheotomy. While being prepared for transfer to the operating room, the patient suddenly died. Both sulfadiazine and penicillin had failed to effect any clinical improvement in the patient.

At autopsy, overwhelming sepsis was disclosed which was initiated by the inflammation of the salivary glands. Abscesses filled with very purulent exudate were found in each submaxillary gland and there was diffuse inflammation of the tissues of the neck. There was also early fibrinous pericarditis and bilateral pleurisy of an early fibrinous nature. Nonhemolytic streptococci were cultured from the abscesses, from the lung and from the abdominal aortic blood, further confirming the impression at autopsy of an overwhelming sepsis.—*1400 North Second Street.*

HEREDITARY HYPERTROPHY OF THE MAXILLA AND MANDIBLE: REPORT OF CASE

C. Richard Miller, D.D.S., Harrisburg, Pa.

History.—A white man, aged 18, well-nourished and well-developed, graduated from high school but was unable to hold a position for any length of time. The chief complaint was poor mastication and a very unattractive appearance (Fig. 1). There was no pain and the disease was slow in its progress. The patient suffered only the discomfort of the disabling deformity which, in this case, caused him to have practically no masticating efficiency and very bad diction. He explained that his mother's mouth was in the same condition but that none of his brothers or sisters had been affected. The remaining history was irrelevant.

Oral Examination.—Examination showed extensive hypertrophy of both the maxilla and mandible which had spaced the teeth and caused facial distortion. The teeth were surrounded by bone and fibrous tissue and there was no evidence of resorption inside of the teeth. The enamel, cementum, dentin and pulp chambers were well formed. All teeth were present but caries was rampant. The patient had occlusion of upper and lower second molars only on both sides and an extreme overbite with protrusion of the lip (Fig. 2, left). The space between the hypertrophied ridges in the posterior portion of the roof of the mouth was approximately ¼ inch (Fig. 2, right).

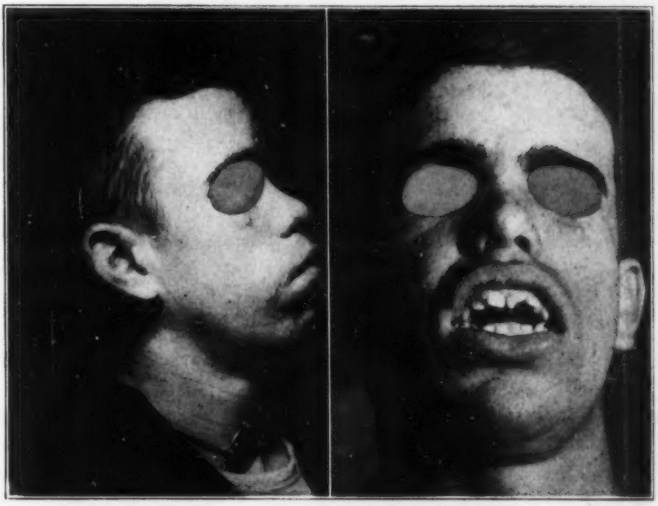


Fig. 1.—Profile and full face views of the patient before treatment.

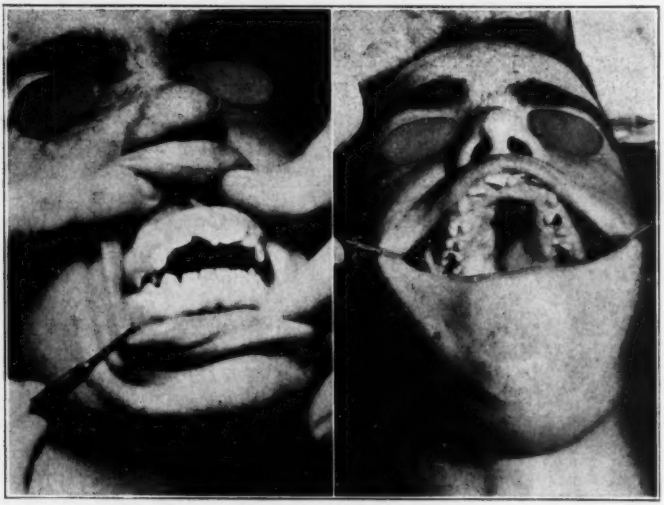


Fig. 2.—Left: Extreme overbite and malocclusion are shown. Right: Extensive hypertrophy of the tissue may be seen.

A complete alveolectomy with extraction of all teeth and resection of the osteofibromatous tissue and the hypertrophied soft tissue of both the maxilla and mandible was deemed advisable. The mouth was divided into quarters and the operation was performed in four stages. The right maxillary region from the central incisor to the tuberosity on that side was selected for the first stage of the operation. I shall describe only this operation as the remaining three were similar.

Operation.—On the night before the operation the patient was given pentobarbital sodium 1½ grains. One hour before the operation, premedication of morphine sulfate ¼ grain and atropine 1/150 grain was given. Conductive anesthesia was used together with infiltration to help control hemorrhage. An incision was made around the cervical margin of the teeth and a mucoperiosteal flap was reflected on the buccal aspect from the central incisor to the tuberosity on the right side of the maxilla. The underlying cortical layer of bone was smooth and shiny and extremely dense and hard. Because the cancellous portion of the bone was very honeycombed and vascular in character, the teeth were extracted with little difficulty. Bleeding was of the oozing type which could not be controlled from any one point. The palatal tissue was reflected from the crest of the ridge to the midline suture of the hard palate. The dense collagenous tissue was dissected and trimmed from the under portion of the palatal flap. The bone was removed with rongeurs, chisels and bone files and an attempt was made to shape the ridge for the best retention of a denture. The buccal and palatal tissues were placed in proximity and approximately ¼ inch of excess tissue was

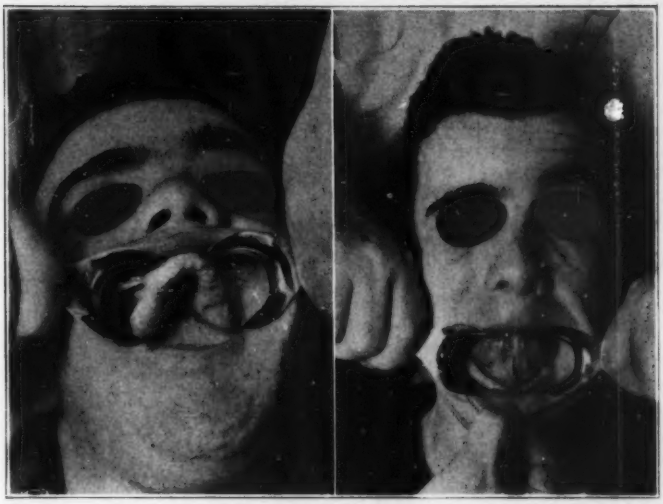


Fig. 3.—Appearance of the patient's mouth after surgical intervention.

trimmed from both the buccal and palatal flaps. The area was sprayed with sulfathiazole powder (microcrystalline) and the tissue was sutured.

Postoperative Course.—Intravenous administration of 1,000 cc. of 5 per cent glucose in physiologic salt solution was started immediately. This was given slowly over a three-hour period. Pain was controlled with morphine sulfate ¼ grain followed by 10 grains of aspirin and codeine ½ grain as required every four hours for the first twenty-four hours. An ice bag was placed on the right side of the face and gauze packs were placed in the mouth to help control bleeding. By the second postoperative day there was extensive swelling with ecchymosis under the right eye and extending over the right cheek, owing principally to the high vascularity within the bony spaces. Oral examination revealed large fibrous clots of blood which were removed. There was a moderate amount of swelling inside the mouth but very little pain. The patient's condition improved gradually and there was no trace of post-extraction trauma within ten days. The second stage of the operation was performed on the left side of the maxilla within approximately two weeks, following the same type of procedure. After a two-week interval, the alveolectomy type of operation was performed in two stages on the mandible. The total time of hospitalization was four months.

Postoperative results are shown in Figure 3.

Pathologist's Report.—Gross: Sections of the lesion consisted of very dense collagenous tissue with no appreciable increase in vascularity. Microscopic: Neither was there evidence of inflammatory reaction or proliferation of young fibroblasts. One section presented a mucosal surface covered by stratified squamous epithelium, free of keratinization and cutaneous appendages. There was no suggestion of malignancy.

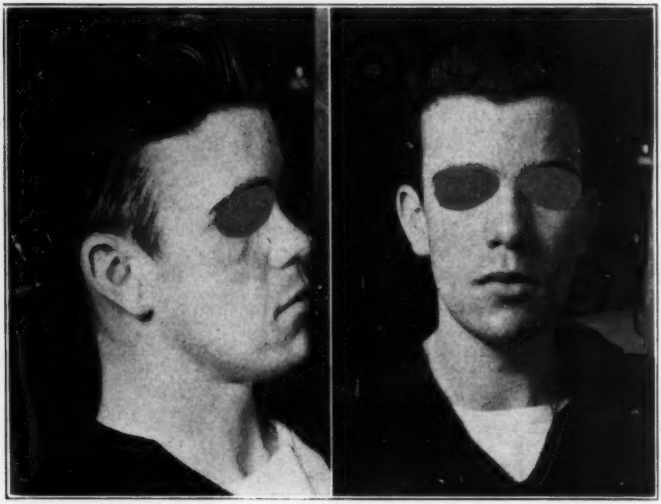


Fig. 4.—Profile and full face views of the patient after treatment.

Diagnosis.—Fibrosis of the alveolar ridge.

Summary.—The greatly improved appearance of this patient (Fig. 4), his apparent new outlook on life and his appreciation of what was accomplished made every effort on our part well worth while.—*1400 North Second Street.*

Concentration is an art of slow acquisition, but little by little the mind is accustomed to habits of slow eating and careful digestion, by which alone you escape the "mental dyspepsy" so graphically described by Lowell in the "Fable for Critics." Do not worry your brains about that bugbear Efficiency, which, sought consciously and with effort, is just one of those elusive qualities very apt to be missed. The man's college output is never to be gauged at sight; all the world's coarse thumb and finger may fail to plumb his most effective work, the casting of the mental machinery of self-education, the true preparation for a field larger than the college campus.—Sir William Osler in "A Way of Life."

SURGICAL CORRECTION OF MANDIBULAR PROGNATHISM: REPORT OF CASE

JOHN W. KEMPER, M.D., D.D.S., Ann Arbor, Mich.

History.—The patient, a white woman, aged 30, stated that she had been embarrassed most of her life because of her marked facial deformity caused by developmental mandibular prognathism (Fig. 1).

Orthodontic treatment was instituted at the age of 21 years with some improvement. However, it was soon seen that surgical intervention was necessary to obtain a good cosmetic and functional result.

The past history was insignificant.

Examination.—Examination revealed a well-developed, well-nourished white woman with marked mandibular prognathism. The chin was rather prominent and the inferior mandibular line was extremely elongated from condyle to symphysis.

Examination of the mouth showed very heavy horizontal rami of the mandible and a prominent mentum. All teeth were in a good state of repair. Teeth missing were the maxillary right first molar, first bicuspid, and left third molar. Also missing were the mandibular left second bicuspid and right first and third molars. There was malocclusion posteriorly with a cross bite on the right. The anterior teeth were biting end to end.

The remainder of the examination was entirely negative. Blood and urine studies were not significant.

Fig. 1.—Photograph of patient taken before surgical correction of prognathic mandible.

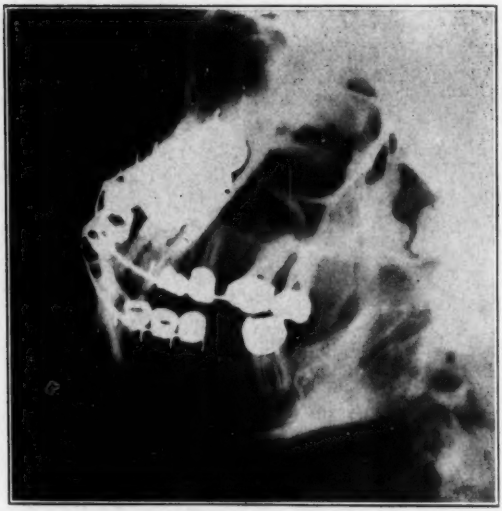


Fig. 2.—Preoperative roentgenogram showing orthodontic appliance in place.

Treatment.—Previous to the patient's admission, study models were made and sectioned to determine the correct amount of bone to be removed from the mandible on either side. It was decided to remove sections from the left through the second bicuspid area and from the right through the first molar region since both of these teeth were already missing.

For immobilization, an orthodontic appliance was constructed and attached to the upper and lower teeth before operation (Fig. 2).

Operation.—The operation was performed under intratracheal nitrous oxide, ether and oxygen anesthesia. An incision was made along the inferior border of the mandible about one inch in length corresponding to the edentulous areas mentioned above. By blunt dissection the periosteum was elevated on the lingual and buccal surfaces of the mandible up to and through the oral mucosa on the crest of the alveolar ridge. A Gigli saw was inserted under the periosteum extending into the mouth and the mandible was severed. A section of the body of the mandible, of the width previously determined on the study models, was removed from either side. There was little bleeding and the anterior fragment of the mandible could be easily shifted posteriorly in approximation with the two posterior fragments. The right posterior fragment containing the one molar tooth in cross bite was shifted medially into normal position. With a surgical drill, small holes were made in each fragment near the inferior border and a small ligature of stainless steel wire was inserted for more adequate stabilization. By means of rubber band traction on the orthodontic appliances, the teeth were then brought into occlusion and fixed (Fig. 3). The mucous membrane and skin margins were approximated with plastic silk and small drains were placed on either side for dependent drainage.

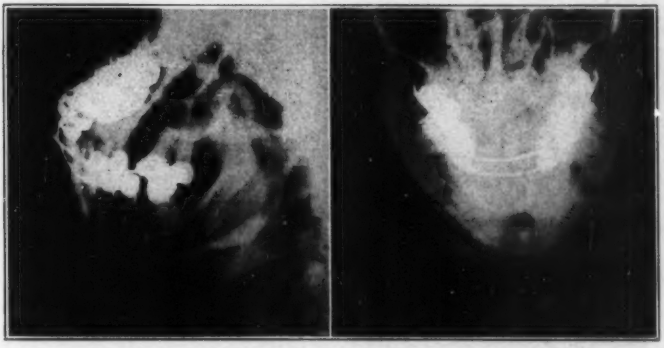


Fig. 3.—Lateral and postero-anterior roentgenograms taken postoperatively.

Fig. 4.—Appearance of the patient after operation.

Course.—Except for swelling of the lower lip, recovery was fairly rapid and uneventful. There was anesthesia of the lower lip owing to sectioning of the nerve.

Nine weeks following operation the appliances were removed and it was found that there was good union on both right and left sides with normal occlusion and a marked cosmetic improvement (Fig. 4). Within three months after operation there was complete return of normal sensation to the lower lip.

The patient has an excellent cosmetic result which has given her considerable mental relief regarding her appearance. She states that this operation has also corrected the slight speech defect she had owing to the mandibular deformity. —*Department of Oral Surgery, University Hospital and School of Dentistry, University of Michigan.*

LOCAL CHEMOTHERAPY OF WOUNDS

For local chemotherapy sulfamylon, 5 per cent, seems to be superior to the 6 other antibacterial substances tested. It possesses the widest range of antibacterial activity and is relatively nontoxic. It is active in the presence of pus and blood and is not affected by changes in the acidity of the environment. It possesses rapid bactericidal activity. Sulfamylon in a concentration of less than 3 per cent should not be used. Neutralized sulfamylon should be used.

Streptomycin is next best. It failed to attack the streptococcus in concentrations of 200 units per cubic centimeter, and this antibiotic is destroyed by increasing the acidity of the environment. Like sulfamylon, streptomycin acts rapidly in the presence of blood and is relatively nontoxic.

Penicillin is placed third. It is nontoxic, but penicillin is readily destroyed by changes in pH and possesses a very narrow range of bacterial activity. Resistant strains are not infrequently encountered and this antibiotic becomes almost worthless in the presence of a mixed infection. Penicillin does not destroy mixed bacteria, and, conversely, penicillin is destroyed.

The mixture of sulfamylon, 5 per cent, and streptomycin is nontoxic, relatively stable in the wound, and has almost a complete range of bacterial activity including the anaerobes of gas gangrene.

Thirty contaminated wounds have been successfully sutured, after a mixture of sulfamylon and streptomycin was used as a subcutaneous antiseptic. Soft white healing was obtained.

This mixture was used unsuccessfully, however, in the treatment of open wounds containing slough and sequestra. The mixture did not prevent the regrowth of pyocyaneus over the surface of wounds or burns.

Tyrothricin, parachlorophenol, and zephiran have a toxicity which permits their use only on granulating wounds.

A pattern is set forth for a method of investigating the efficacy of antibacterial substances for local chemotherapy of wounds.—*Howes, in Surg., Gynec. & Obst. 83:13, July 1946.*

COMPOUND COMPLETELY DISPLACED FRACTURE OF THE MANDIBLE: REPORT OF CASE

RALPH G. PETERSON, D.D.S., Minneapolis

History.—A white boy, aged 5, was injured in an automobile collision on July 5, 1942. He was thrown clear of the automobile, onto a rough highway. He was taken to a nearby town where he was given anti-tetanus gas gangrene antitoxin serum and supportive treatment, and the skin abrasions and bruises were cleaned and dressed. The facial injuries, which were the severest, were cleansed and dressed. No further treatment was given. The patient was brought 200 miles by ambulance to St. Mary's Hospital, Minneapolis on the next day.

Roentgenographic Examination.—Roentgenograms were taken after admission (Fig. 1). The lateral jaw (A), postero-anterior (B) and occlusal dental films, (C) showed a compound comminuted completely displaced fracture of the left side of the mandible. There was no fracture of the skull or of the other bones.

General Examination.—The boy was badly bruised. He had no internal injuries, or fractures other than that of the mandible. The severe injuries were about the head and face. There was a ragged through-and-through gaping laceration in the left cheek extending half the distance between the corner of the mouth and the lobe of the ear. There was a compound fracture of the mandible on the left side which was plainly visible through the cheek laceration. The boy was extremely uncooperative and difficult to examine, and further examination was done in the operating room when he was anesthetized.

Exploratory Findings and Operative Procedure.—Under ether anesthesia examination revealed a through-and-through laceration of the left cheek extending one and one-half inches back from the corner of the mouth. The lower lip was lacerated and the left side was pushed back into the mouth and pinched between the fractured fragments at the inferior border of the mandible. The buccal gum and mucosa of the left side of the mandible were torn loose from the region of the deciduous cuspid and extended backward, leaving the whole body of the mandible denuded of tissue as far back as the angle of the mandible. There was a compound fracture of the mandible on the left side between the deciduous second molar and the permanent first molar. The fracture was complete with total displacement of the posterior fragment to the buccal side and overriding the first deciduous molar. There was a loose fragment, containing the deciduous second molar, which was separated from the anterior fragment. It was assumed that there was complete paresthesia in the anterior left side of the mandible and in the lower left side of the lip. Upon manipulation, profuse hemorrhage arose but stopped after forcible reduction of the fractured bone fragments.

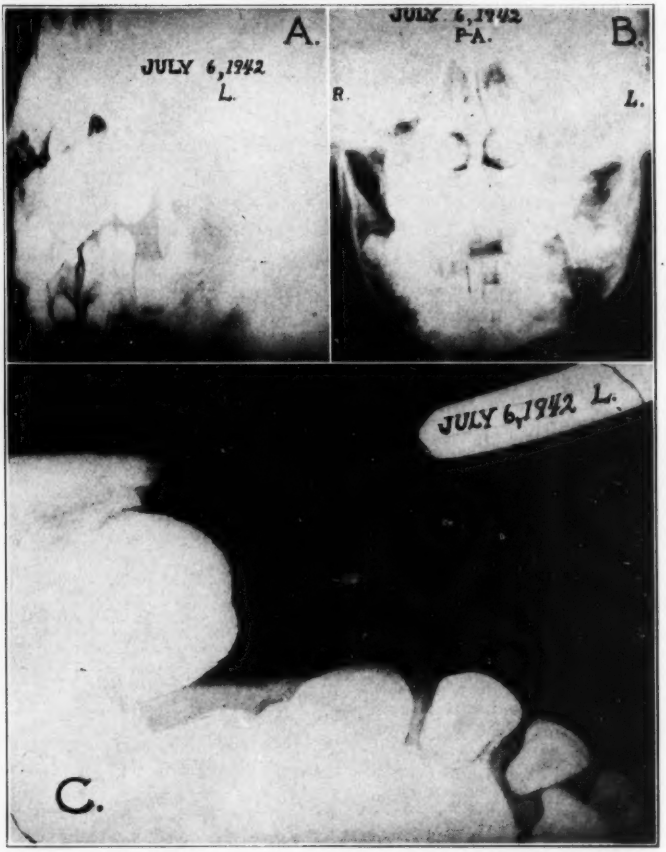


Fig. 1.—Roentgenograms showing compound completely displaced fracture of the mandible of a boy aged 5. (A) Lateral view; (B) postero-anterior view; and (C) occlusal view taken with the regular sized dental film, showing the override and the complete displacement to the buccal side. (Photograph enlarged)

A fulcrum type modified Risdon wire arch was applied to the lower teeth beginning on the left side, using the deciduous left first molar as the fulcrum point because of looseness of the fragment which retained the deciduous second molar. The permanent first molar had the entire mesial root exposed to its apex. The tooth was loose but firm enough to control the posterior fragment of the mandible. The deciduous second molar was left primarily to maintain the space. An upper Risdon wire arch bar was applied to the upper teeth. Intermaxillary tie wires were applied, but these were left loose to allow sepa-

Fig. 2.—Postoperative lateral view of the left side of the mandible during treatment.

ration of the jaws in case of postoperative emesis. Rubber bands were also applied to immobilize the mandible partially immediately after operation. The loosened gum tissue was approximated as well as possible to the mandible and sutured. Minimal débridement and coaptation of the mutilating cheek laceration were done. The laceration was sutured with C deknatel silk intraorally and the skin was closed with C deknatel silk by subcuticular continuous suture and intermittent skin sutures. Sulfanilamide powder was inserted locally into the wounds before closure. The time of the operation was about four hours. The patient was practically awake before leaving the operating room and was in good condition.

Postoperative Treatment.—The patient was given 500 cc. of glucose in physiologic saline solution intravenously shortly after he returned to his room. The next day he was placed on a thin liquid diet. His diet was modified later to include puree of vegetables and fruits. One-fourth gram of sulfadiazine dissolved in water was prescribed to be taken each four hours. The first few days he was extremely uncooperative and restless, and complained of pain in the face and the jaw. Morphine sulphate 1/12 grain was given hypodermically as indicated. Saline mouth wash was used each two hours. Dressings were changed daily and the wounds were treated with aqueous merthiolate.

A few days later the cheek laceration became infected and some of the outside skin sutures sloughed loose. Inside of the cheek the mucosa was healing well. The patient was allowed to be up in a wheel chair.

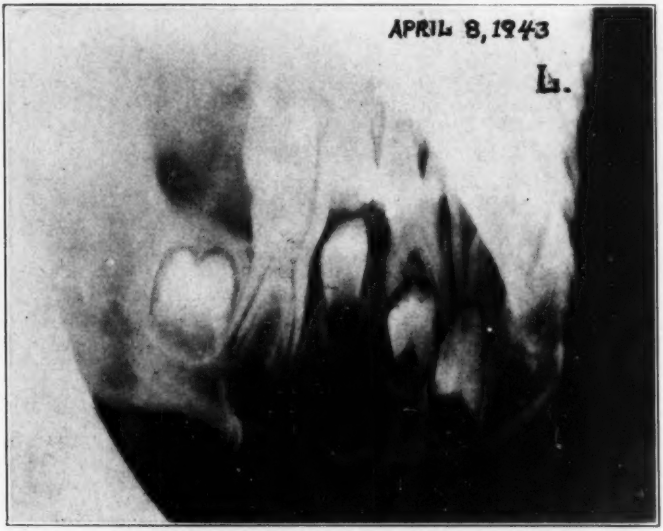


Fig. 3.—Postoperative lateral view of the left side of the mandible nine months after the fracture was reduced. The marked resistance of developing permanent teeth to injuries and infection is well demonstrated.

On the next day the cheek wound began to separate and more skin sutures sloughed loose. The mucosa along the mandible also began to separate, re-exposing the bone along the buccal surface in the region of the fracture.

The few remaining sutures on the face sloughed loose and were removed the next day. The skin margins on the face wound had now separated one-fourth of an inch. The inside mucosa was closed and healing well. The patient was given chloral hydrate 15 grains by rectum. The intermaxillary rubber bands were removed and the previously applied intermaxillary tie wires were tightened to obtain better immobilization of the mandible and improved occlusion.

Sterile cotton rolls were placed on the face near the separated skin margins and compressed with adhesive tape strips. This reapproximated the skin margins as well as possible.

The face was healing well by July 20, 1942. It was apparent that a widened scar would result. Inside of the mouth there was an area of exposed bone about 2 cm. long and 1½ cm. wide on the buccal surface of the mandible overlying the permanent first molar and the deciduous second molar. All remaining sutures inside of the cheek and in the gum mucosa were removed.

A postoperative roentgenogram taken July 23, 1942, showed favorable healing (Fig. 2).

The patient was discharged from the hospital one week later.

The exposed bony plate along the mandible did not completely separate

and loosen until the first part of September, eight weeks after the accident. The patient was readmitted to St. Mary's Hospital on September 12, 1942.

Second Operation.—Under nitrous oxide and ether anesthesia, the intermaxillary tie wires were cut and the mouth was opened for the first time since the previous operation. There was good clinical union of the bone. All wires remaining in the mouth were removed. A bone plate sequestrum on the buccal surface overlying the permanent first and second molars was removed. It measured about one inch long and one-half inch wide. An alveolar process sequestrum containing the deciduous second molar was also removed. Underneath the bone sequestra a layer of granulation tissue covered the deeper bone and the permanent second bicuspid crown was exposed openly to view. The erupted crown was chalky in appearance.

Course.—Further recovery was uneventful and on November 12, 1942, the patient was considered fully recovered. The scar on the face had diminished in size by April 8, 1943, but was conspicuous. The permanent second bicuspid tooth was abnormally erupted. The crown was chalky and pitted but was to be retained. There was a deepened crevice along the mesial root of the first permanent molar but the tooth was firm and in its normal occlusion. No vitality test of the tooth was made. A lateral jaw roentgenogram was taken and showed complete ossification in the healed fracture. There was a definite bony callus along the inferior border of the mandible (Fig. 3). It was difficult to determine the extent of recovery from the paresthesia in the lip but some recovery had taken place.—*950 Medical Arts Building.*

THE PROBLEM OF HEMOPHILIA IN ORAL SURGERY

RALSTON I. LEWIS,* D.D.S., and WILLIAM JACK,* M.D., Chicago

Hemophilia may be defined as the tendency to bleed inherited by males. It is characterized by a markedly prolonged coagulation time of the blood while the bleeding time remains normal. The tendency to bleed appears early in life and is present throughout life, although it becomes less severe as age increases. Bleeding in the hemophiliac follows trauma rather than occurring spontaneously. The disease and its hereditary tendencies have been known for centuries. The defect is transmitted as a recessive sex-linked characteristic and follows the laws of the mendelian pattern, in that it affects only the male. The female is always the carrier. It is not transmitted through the unaffected male. Although it is theoretically

Read by Ralston I. Lewis, D.D.S., before the American Society of Oral Surgeons, Miami Beach, Fla., October 10, 1946.

*From the Medical Clinic of Henrotin Hospital, Chicago.

possible for the female to inherit the disease, no such case has been recorded in the literature. The possibilities of its transmission, outlined by Fowler,[1] are as follows:

1. The hemophiliac male and the normal female:
   A. The sons are not bleeders and cannot transmit the disease.
   B. All daughters are carriers.
2. The normal male and a female carrier:
   A. One-half of the sons are bleeders.
   B. One-half of the daughters are carriers but there is no method of determining the carrier from the noncarrier.
3. The hemophiliac male and a female carrier:
   A. One-half of the sons are bleeders.
   B. One-half of the daughters are carriers and one-half of the daughters should be bleeders, although no case has been observed.

Hemophilia is world-wide. Members of the royal families of Russia and Spain are notable examples of hemophiliacs. The disease occurs predominantly in the white race, although it has also been observed in the Negro.

A delay in the coagulation time has long been recorded as the fundamental defect in the disease; but the exact cause has not been clear despite extensive research.

It has been presumed that, since the disease occurs predominantly in the male, some abnormality in the functions of the sex glands was responsible. This presumption led to transplantations of ovaries to the hemophiliac, but the therapeutic results have been nil. The fact that the coagulation time is prolonged while the bleeding time remains normal differentiates hemophilia from hemorrhagic purpura. Thrombin, prothrombin and fibrogen are all present in the hemophiliac in normal amounts, but prothrombin is converted to thrombin much more slowly. This has been thought at various times to be the factor responsible for hemophilia, but the researches of Howell[2] disprove this theory. The platelet count in hemophilia is always normal.

Pohle and Taylor[3] have recently discovered a fraction of the blood globulin which they call the anti-hemophilia factor. An absence of this factor may be the cause of hemophilia but further research is necessary before this fact can be established finally.

The clinical characteristic of hemophilia is the tendency to uncontrollable bleeding. The bleeding may be very profuse or merely a slow oozing, but it is of long duration and is unaffected by the usual hemostatic measures. It usually follows an injury of some type; the slightest contusion, scratch

1. Fowler, W. M. and Degowin, E. L., *Hematology*. New York: Paul B. Hoeber, Inc. (Medical Department of Harper & Brothers), 1945.

2. Howell, W. H., Hemophilia. *Bull. New York Acad. Med.* 15:3 (January) 1939.

3. Pohle, F. J. and Taylor, F. H. L., The Use of a Globulin Substance Derived from Normal Human Plasma. *J. Clin. Investigation*. 17:677 (September) 1938.

or bruise may cause fatal hemorrhage. Fatal hemorrhages have been reported as the result of extraction of a tooth, loss of a deciduous tooth or a minor operation such as circumcision. The tendency to bleed varies. There are intervals during which bleeding is slight, and the coagulation time may be shortened, but it is never normal. During the active stage, coagulation time is greatly prolonged and hemorrhages occur on the slightest provocation. The course of the disease is alternately quiescent and active.

One of the serious after-effects of hemorrhage is infiltration of the blood into the joints. Almost every hemophiliac, at one time or another, bleeds into one of the larger joints, especially the knee or elbow. After hemarthrosis, mild panarthritis occurs followed by fibrositis and ankylosis of varying degree. As a result of ankylosis, the adult hemophiliac usually is crippled to some extent.

The diagnosis of hemophilia depends on demonstration of the presence of a life-long tendency to bleed, together with a maternal history of predisposition of the male to bleed. Obstinate hemorrhage is more often caused by local injury or disease than by abnormalities of the blood; and the mere fact that bleeding persists does not justify a diagnosis of hemophilia. It is obvious, therefore, that the mechanism of different types of hemorrhage is still subject to controversy.

Regarding the treatment of hemophilia, no specific form of treatment has been found. Placental extract is the best means of temporarily lowering the coagulation time as a preventive measure. Transfusion is most effective in active hemophilia, and repeated transfusions may be necessary. The transfusion reduces the coagulation time but the result is only transient, and is effective from eighteen to forty-eight hours only.

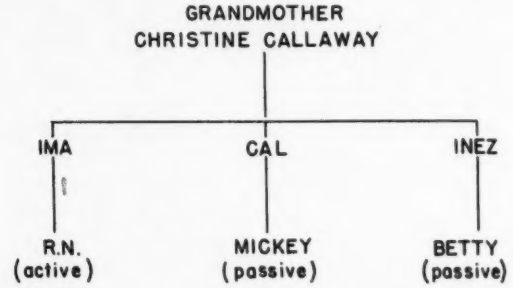
Early in 1941, a young man, aged 28, came for treatment of a trivial laceration of the left thigh. He gave a history of repeated hemorrhages, beginning in infancy. Some were severe and, a number of times, all but fatal. In questioning him about his family history we learned that for many generations the maternal line had produced bleeders. He had a prolonged coagulation time of four hours and forty minutes, but the bleeding time was normal. Bleeding continued from this trivial laceration for a number of days and a large hematoma of the left thigh developed. There was a tremendous distention of the left knee owing to intra-articular bleeding. The patient's red blood cell count fell rapidly from an original 5,300,000 to 2,100,000 and transfusions were necessary. He was hospitalized for three weeks.

In the intervening years he has had a total of twelve such hemorrhagic episodes, each threatening death. Two resulted from extraction of teeth, one by a method inducing exfoliation. All followed the same general pattern of hemorrhage: anemia, and the involvement of one or more joints. At present the patient has a 50 per cent loss of motion of the left

elbow, ankylosis of the right knee with 30 per cent loss of both flexion and extension, and a lesser degree of involvement of the right wrist.

This case, therefore, exhibits all of the classic signs of hemophilia. There is the tendency to uncontrollable bleeding since infancy in a boy born into a family whose males on the maternal side were bleeders. The patient shows a prolonged coagulation time, although the bleeding time remains normal, and shows, at the age of 33, ankylosis of various joints which makes him in some degree a cripple.

A second case is that of a patient who was a true hemophiliac. He presented himself on September 9, 1943, with a badly infected lower left first molar. Because the physician was acquainted with the patient's physical makeup, he was anxious that I get in touch with him before removing the tooth. We found that the patient had an infection of the lower left first molar. The infection extended down the neck. The patient's temperature was 102°. Owing to the seriousness of the operation and the condition of the patient, it was decided to administer gas and oxygen anesthesia.



The results were satisfactory in every way. The patient was taken directly to the hospital where he continued to bleed for two days. A transfusion was given on the third day, and, on the fourth day, an intravenous injection of 1,500 cc. of 10 per cent glucose, resulting in a rapid recovery and his dismissal from the hospital in four days. On admission to the hospital the patient's red blood cell count was 3,400,000 and his white blood cell count 9,500. Two days later, the red blood cell count was 1,990,000 and the white blood cell count 4,850. Ecchymosis extended from his thigh down to and including his foot. This condition is not unusual in cases of hemophilia.—*25 East Washington Street.*

TANTALUM IN TEMPOROMANDIBULAR ARTHROPLASTY: REPORT OF CASE

J. Orton Goodsell, D.D.Sc., Saginaw, Mich.

In many surgical fields, during the past few years, tantalum has been employed when the need for such a material has been apparent. It seems that tissue tolerance for this metal has been adequately demonstrated by an abundance of clinical reports. Therefore, it follows that it is logical to consider tantalum as a material which can be interposed between bone ends to prevent reunion after arthroplasty for correction of temporomandibular ankylosis. The following case report illustrates an apparently successful attempt to restore mandibular function through the use of tantalum.

REPORT OF CASE

History.—A girl, aged 13, was first seen on November 17, 1941, and presented fibro-osseous ankylosis of the left temporomandibular joint (Fig. 1, right). When only a few months old, she had fallen to the floor and had struck the symphysis of the mandible. Shortly thereafter, the mother noticed limitation of motion which developed into complete fixation when the child was two years old. At that time, an unsuccessful attempt at condylar resection was made. There was a linear scar in front of the left ear as evidence of the procedure. At the time of our first observation of the patient, the vertical opening possible in the incisor region was about 2 mm.

First Operation and Course.—On September 2, 1942, a Risdon[1] type arthroplasty—resection of the ramus—was performed. Masseter muscle tissue was inserted between the ends of the severed bone. Immediately after this

Fig. 1.—Right: Roentgenogram taken January 29, 1942, shortly after the patient was first seen. Left: Roentgenogram taken September 17, 1945, indicating reunion that occurred after the operation on September 2, 1942. The anterior portion of the site of resection remains unossified.

1. Risdon, Fulton, Ankylosis of Temporo-Maxillary Joint. *J.A.D.A.* 21:1933 (November) 1934.

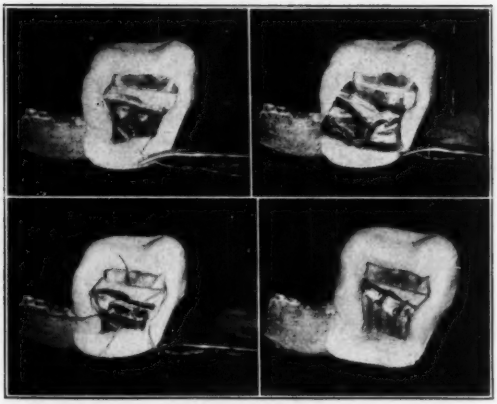


Fig. 2.—Upper left: The wire retractor is in place and the drill holes have been countersunk. Upper right: The tantalum has been placed over the end of the severed bone. The rubber sponge was used as a press. Lower left: The foil has been adapted and trimmed. Stainless steel wires are inserted through the foil and drill holes. Lower right: The wire sutures have been twisted down and cut, holding the tantalum in position.

operation, the mouth could be opened to normal extent. When the patient was next seen, on August 19, 1943, union at the posterior end of the site of the resection had taken place and motion again was limited. On September 17, 1945, another examination revealed increased immobility and filling in of bone at the site of the last operation (Fig. 1, left). Therefore, it was decided to perform a second Risdon type arthroplasty and to interpose tantalum between the bone ends.

Second Operation.—On November 6, 1945, the patient was anesthetized with ether and the second operation was performed. A slightly curved incision of 3 cm. was made through the skin and fascia over the old scar line under the left angle of the mandible. The point of insertion of the masseter muscle was exposed and the muscle was cut transversely near the inferior border. The upper portion of the masseter muscle was then reflected from the bone and the parotid gland and masseter muscle were retracted upward, exposing the middle third of the ramus. A vibrating saw was employed to resect the ramus horizontally at a point above the mandibular foramen. A wire loop was placed around the top of the lower fragment and used as a retractor to pull the butt end of the bone into view facing the operator (Fig. 2, upper left). The edges of the bone were smoothed with files. Two holes were drilled through the lower fragment, running upward to the midline of the mediolateral diameter. A large antrum bur was used to countersink the lateral openings of the drill holes slightly. These saucerized spots enabled the operator to place wires more easily at a later stage. Tantalum foil, trimmed roughly to shape, was laid over the end of the bone and forcibly pressed to contour

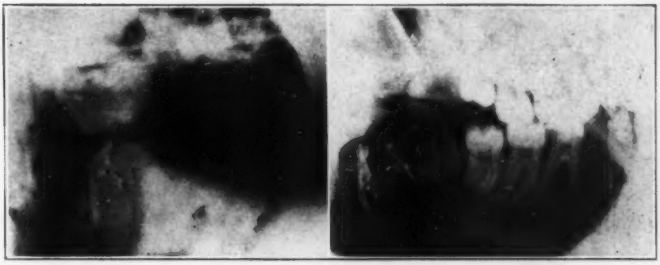


Fig. 3.—Left: Appearance of site of resection, November 16, 1945, ten days after operation. Right: Appearance of same site on December 19, 1945.

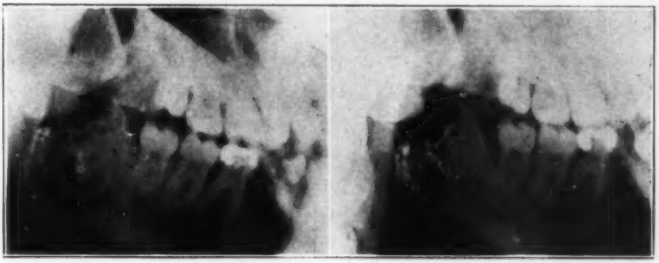


Fig. 4.—Left: By February 25, 1946, very little change in appearance of tantalum is seen. Right: By September 1, 1946, little change in fragmentation may be seen.

by inserting a large piece of sponge rubber into the cavity (Fig. 2, upper right). The margins, being clearly demarcated, could then be trimmed with scissors and the foil was re-applied in close adaptation. Two stainless steel wires, placed through the tantalum and the drill holes, served to immobilize the foil (Fig. 2, lower left and right). Sulfanilamide powder was dusted lightly into the wound which was closed in layers.

Postoperative Course.—Penicillin was employed prophylactically for several days. Slight numbness of the left side of the lower lip was present for about two months, but this complication completely disappeared. The patient was examined periodically until September 1, 1946, when she was last seen (Figs. 3 to 5). On this date, she could open her mouth to normal limits, function was perfect and there was no discomfort of any kind.

COMMENT

The tantalum foil used in the operation reported here was a trifle too thin. Manipulation produced fragmentation of portions of the metal cap which showed during the operation and also in the later roentgenograms. However, this defect in material did not seem to interfere with the final result. Dr. Herbert L. Davis[2] suggests that .0005, .00075 or .0025 inch

2. Davis, Herbert L., Ethicon Suture Laboratories, New Brunswick, N. J. Personal Communication.

Fig. 5.—Illustration of the patient's normal mandibular function by September 1, 1946. Right: The scars, preauricular and submaxillary, can be seen. The width of the latter scar can be accounted for, in part, by rapid increase in the patient's weight since the last operation and by two surgical approaches.

tantalum foil probably would not fragment and could be molded by application of a rubber sponge, as described above. The only foil which we had available when our case was operated on was apparently only .00025 inch in thickness. The fragility of this gage has caused discontinuation of its manufacture.

Numbness of the lip was an unexpected complication, because the resection was made well above the mandibular foramen. It would seem that scarring from the previous operation may have bound down the inferior alveolar nerve so that it was less able to move away from an offending instrument such as a saw.

In our opinion, a Gigli saw should not be used in these cases. The bone is likely to be extremely wide in its mediolateral diameter and in close contact with the vessels in the pterygoid space. Injury to this region can result in extremely embarrassing hemorrhage if a medially-placed Gigli saw encounters large vessels.

It is realized that one case does not constitute extensive proof, but it would seem from the result obtained here that the procedure is worth further trial. We have not employed this technic since operating on this patient because we wished to give what we considered ample time to a proper observation before repetition. Almost a year has elapsed since the operation and we believe that this technical variation may be of some assistance in the solution of problems of temporomandibular ankylosis. If it does prove worthy, on further trial, it may be of considerable value. It is a simple, rapidly performed operation with easy access, requiring no great technical skill—as compared with that needed for the classic approach by way of the condyle region—and it avoids such structures as

the internal maxillary artery and the seventh nerve, which are the chief hazards in the usual procedure. The least that can be said with reference to this case is that tantalum has seemed to produce a good result after failure of two previous operations of different types.

Since this report was written, we have learned that Eggers[3] utilized tantalum foil in a case of temporomandibular ankylosis. Although his purpose was the same as ours (prevention of reunion by tantalum interposition), his approach and technic were different. He substituted the foil for temporal fascia and folded it over the severed bone ends after performing the classic pre-auricular arthroplasty at the condyle neck. He relied on the elevation of the mandible by the masseter muscles to hold the material in place without sutures. His postoperative report indicated a satisfactory outcome in the case of a child aged 4.—*501 Second National Bank Building.*

3. Eggers, G. W. N., Arthroplasty of the Temporo-Mandibular Joint in Children with Interposition of Tantalum Foil. *J. Bone & Joint Surg.* 28:603 (July) 1946.

FRACTURES INVOLVING THE MANDIBULAR CONDYLE: A POST-TREATMENT SURVEY OF 120 CASES*

MEMBERS OF THE CHALMERS J. LYONS CLUB

This investigation of cases of mandibular fracture will be confined to those which occur above the mandibular notch and sever the articular head of the condyle from the ascending ramus. Most of the literature on condylar fractures is incomplete, and sporadic accounts which describe treatment of a small number of cases fail to give a comprehensive picture of fracture management.

Structurally, the point of least diameter at the neck of the condylar process appears to be the point most vulnerable to mandibular fracture. However, clinical statistics reveal that only 8 per cent of mandibular fractures occur at the condylar site and that greater incidence is in the mental foramen, the angle and the symphysis regions. An apparent increase in the number of traumatic fractures of the mandibular condyle in recent years may be attributed to the growth of a hazardous mechanized environment.

Read before the Twenty-Eighth Annual Meeting of the American Society of Oral Surgeons, Miami Beach, Fla., October 12, 1946, by J. O. Goodsell.

*Data correlated and paper prepared by J. R. Hayward, D.D.S., assistant resident in oral surgery, University Hospital, University of Michigan, Ann Arbor, Mich. Material and data provided by members of Chalmers J. Lyons Club under the supervision of Drs. J. W. Kemper, D. H. Bellinger and J. O. Goodsell, Chairman, Fracture Survey Committee.

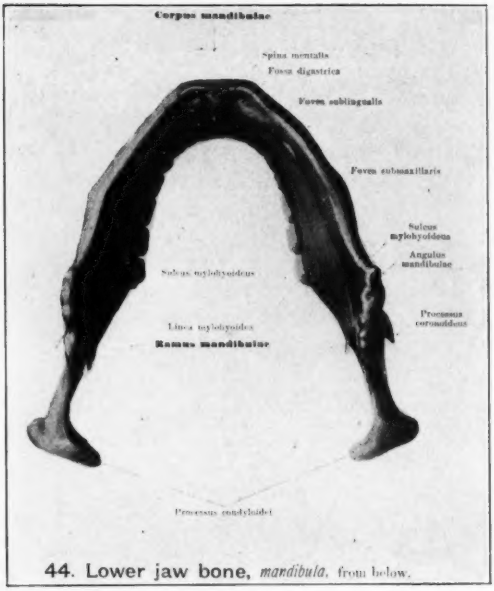


Fig. 1.—Direction of long axes of condylar heads. (Spalteholtz)

ANATOMIC CONSIDERATIONS

In order to appreciate the problems of treatment in cases of condylar fracture, it is necessary to review the relations of regional anatomy. The condylar processes terminate in transversely directed, roller-like heads which are partially covered by hyaline cartilage for articulation with the fossa and articular eminence of the temporal bone. Lines projecting from the long axes of the condylar heads would converge medially and posteriorly toward the foramen magnum (Fig. 1). Below the condylar head, a depression on the anteromedial surface of the constricted neck is the site of insertion of the external pterygoid muscle, except the sphenomeniscus component, which inserts into the disk of the temporomandibular joint. The anterior, medial and slightly upward pull of the external pterygoid muscle plays an important role in the typical displacement of condylar fragments in that direction. The condylar head is articulated by the temporomandibular joint, at rest, in the mandibular fossa of the temporal bone, bounded anteriorly by the articular eminence and posteriorly by the tympanic plate. In the region of the mandibular fossa, the temporal bone is thin, and penetration of the condylar head into the middle cranial fossa

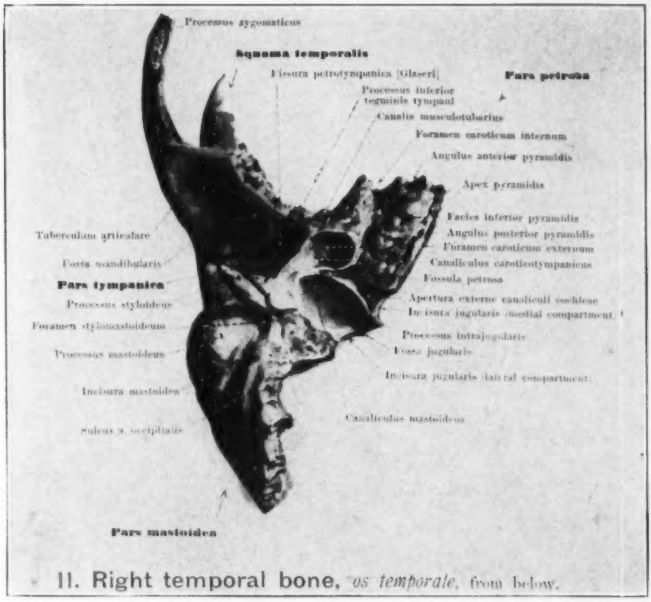


Fig. 2.—Mandibular fossa relations in the temporal bone. (Spalteholtz)

may be a fatal complication of trauma in the region. The anterior articular portion of the mandibular fossa is outlined by the petrotympanic fissure which bisects the fossa posterolaterally (Fig. 2) and transmits the anterior tympanic artery. The chorda tympani nerve lies in a bony canal in the fissure but leaves the skull medial to the fossa and to the spine of the angle of the sphenoid bone anteriorly. Behind the petrotympanic fissure is the nonarticular portion of the fossa, which contains the auriculotemporal nerve and a portion of the parotid gland. Perhaps the gland cushions to some extent the force of posteriorly displaced fractures. Direct displacement may comminute the thin tympanic plate and produce hemorrhage from the external auditory meatus.

The wall of the temporomandibular joint is a loose, thin capsule which surrounds the cartilaginous articular portion of the mandibular fossa and articular tubercle and inserts in the area of the upper condylar neck. The joint cavity is divided into two chambers by a specialized disk of fibrocartilage (Fig. 3), which unites peripherally with the capsule and anteriorly with the insertion of the sphenomeniscus muscle. Laterally, the joint capsule is reinforced by the heavy bands of the temporomandibular ligament extending posteriorly and inferiorly from the zygomatic arch to the lateral

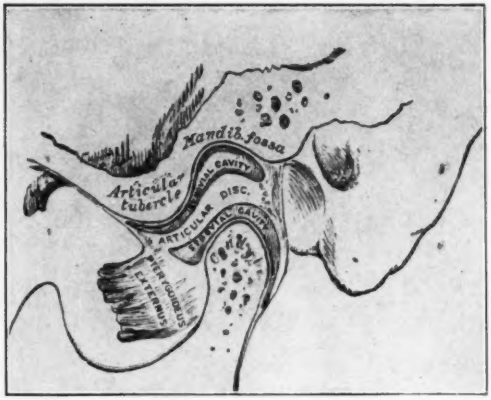


Fig. 3.—Parasagittal section demonstrating temporomandibular joint structure. (Gray)

and posterior surfaces of the condylar neck. The sling-like action of this ligament is important in normal joint function. Medially, the capsule is thin and not well supported. Rupture at this site with medial dislocation of the condylar head is frequently seen in fracture of the condyle. The stylomandibular and sphenomandibular ligaments are of less importance, but their proximity warrants consideration. Textbook diagrams represent these ligaments as narrow straps. Upon dissection they are found to be wide bands. Extending from the spine of the angle of the sphenoid bone, the sphenomandibular ligament is attached along the posteromedial surface of the ascending ramus from the neck of the condyle to the level of the lingula. Between the ligament and condylar neck are the external pterygoid muscle and internal maxillary vessels. From the styloid process of the temporal bone, the stylomandibular ligament fans out to insert along the posterior border of the ascending ramus from the condylar neck to the angle of the mandible. Overriding of the fragments frequently follows condylar fractures. This condition results from the powerful upward contraction of masseter, internal pterygoid and temporal muscles upon the ascending ramus. Superficial structures in proximity to the condylar process are the parotid gland, auriculotemporal nerve, superficial temporal vessels and significant branches of the facial nerve. The internal maxillary artery and pterygoid venous plexus are important structures deep to the condyle.

CLASSIFICATION

As in all fractures classified by specific site, great variation exists in fractures of the mandibular condyle. These variations must be carefully evaluated in the management of individual cases, since no stereotyped

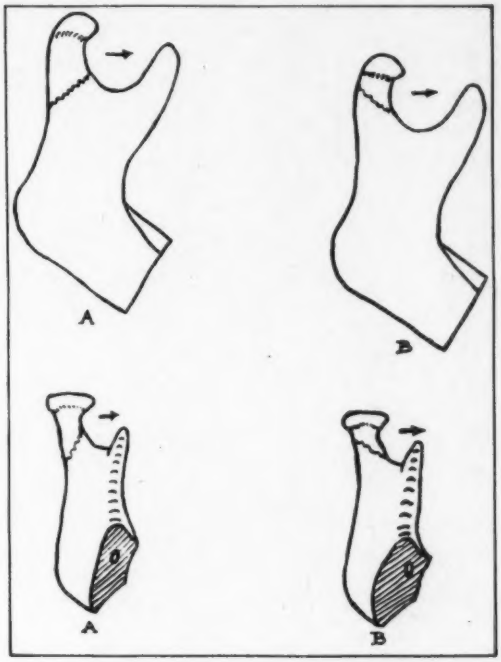


Fig. 4.—Diagrams indicating significance of fracture line to displacing force of external pterygoid muscle. A: Resistance to displacement. B: No resistance to displacement.

procedure will cover all of the problems which arise. Fractures may be unilateral or bilateral, and significant differences exist in the line of fracture, fragment displacement, malocclusion, altered function, asymmetry and other deformities. Frequently the break is indirect, resulting from force transmitted from a blow on the chin. For example, a frontal blow may produce indirect fractures of both condylar necks with or without a direct fracture of the symphysis. A lateral blow to the chin commonly produces indirect fracture of the condylar neck on the opposite side.

Displacement of the fractured condylar fragment is determined by the following factors: the nature, severity, and direction of traumatic force; the occlusion of the teeth and position of the mandible at the moment of impact; the line of fracture; and the influence of muscle pulls, ligament reinforcements and other anatomic considerations. The line of fracture determines to some extent the displacement of the condylar fragment. Less displacement will be found if the plane of the fracture locks the

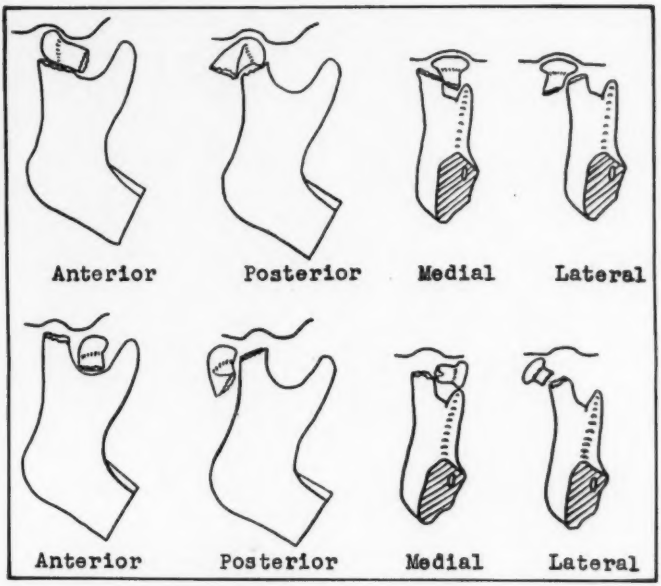


Fig. 5.—Above: Diagrams illustrating displacement in condylar fractures. Below: Diagrams illustrating dislocation in condylar fractures.

fragments against the anteromedial pull of the external pterygoid muscle (Fig. 4).

Displacement fractures are those in which the condylar head remains within the limits of the temporomandibular joint. The degree of displacement may range from none to a wide malposition of the ends of the fractured bone with marked overriding. Since fracture lines are usually oblique, the upward pull of three major masticator muscles readily slips the fragments into an overriding position. When there is sufficient trauma to rupture the joint capsule and to expel the condylar fragment from the joint fossa, the condition is termed dislocation. Both displacement and dislocation are classified as anterior, lateral, medial and posterior (Fig. 5).

CLINICAL DIAGNOSIS

The clinical signs of fracture of the mandibular condyle may be scarcely perceptible and symptoms may be negligible or absent. Frequently, roentgenographic findings are the first to disclose a condylar fracture. All degrees of signs and symptoms may be present, and it is surprising to find that there is no constant correlation between extent of fragment displacement and magnitude of clinical deformity. In spite of marked displacement evidenced

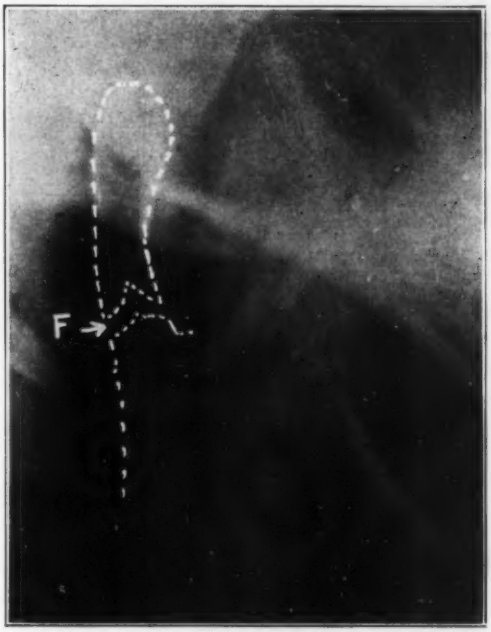


Fig. 6.—No displacement.

in the roentgenogram, there may be no occlusal imbalance or significant functional disturbance. (A similar adaptive response may be observed in the adjustment to adequate function made after resection of the condylar heads.) Fractures with minimal displacement are usually unaccompanied by great deformity or functional disturbance. Clinically, upon digital palpation of the anterior wall of the external auditory meatus, an absence of normal excursion of the condylar head will be found on the side of fracture. Palpation at the preauricular fracture site may reveal crepitus during function. Gross displacement of the condylar head may be disclosed by palpation, if it is not masked by edema. Preauricular pain may be manifest, with an increase in tenderness during excursions of the mandible. In direct fractures, contusion, swelling and other obvious traumatic signs are found.

Disturbance in occlusal relationship of the teeth is commonly present. Fractures complicated by overriding shorten the distance between the angle and the mandibular fossa. In unilateral fracture the posterior teeth on the affected side are brought into premature contact, thus producing an open bite on the opposite side and in the anterior region (Fig. 15, left). Frequently a retro-occlusion of the posterior mandibular teeth is found on

Fig. 7.—Posterior displacement.

Fig. 8.—Anterior displacement of condylar process and fracture of the coronoid process. (Two cases)

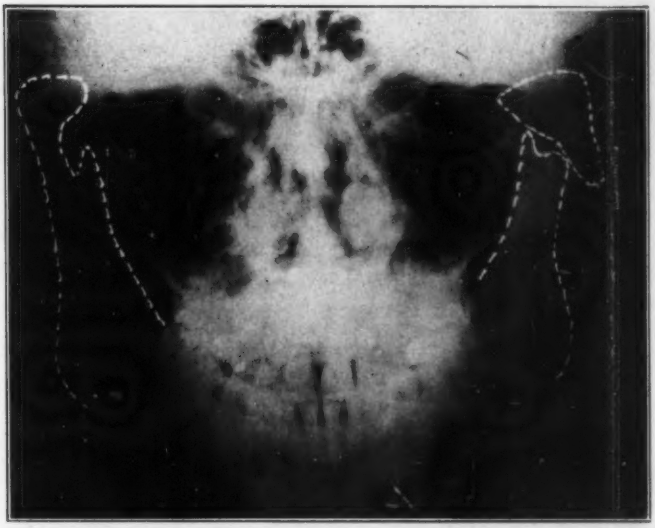


Fig. 9.—Lateral displacement of unilateral fracture.

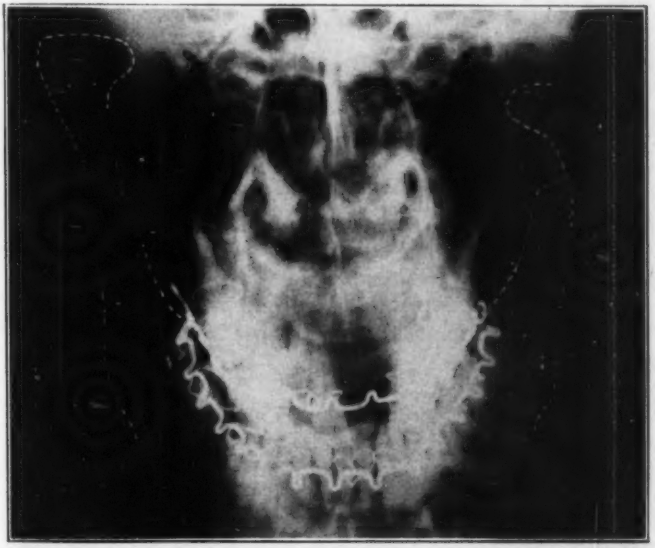


Fig. 10.—Bilateral fractures with no displacement on the left side and lateral displacement on the right side.

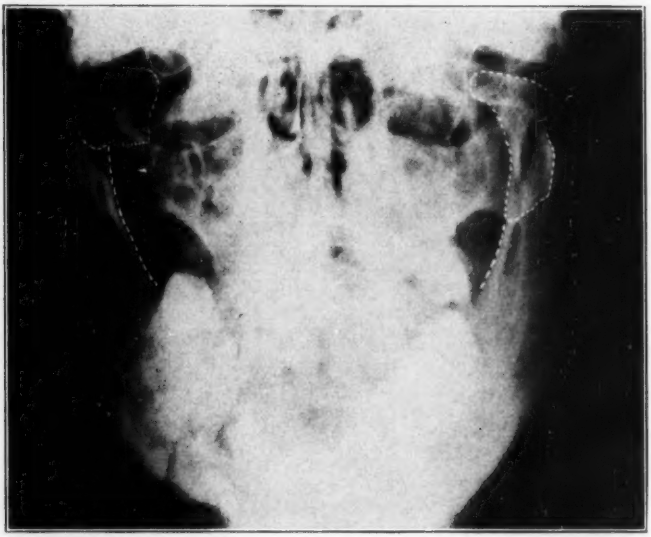


Fig. 11.—Bilateral condylar fractures with anteromedial dislocation.

the affected side. When the mouth is open, the distance between occlusal surfaces is less on the affected side than on the normal side (Fig. 15, right). The chin will also be deviated toward the affected side. Bilateral condylar fractures with upward and posterior displacement of the mandible produce premature contact of the posterior teeth and an open bite anteriorly. In such cases, protrusive excursion of the mandible is impossible. In edentulous cases, condylar fractures produce similar changes in interarch distances and relationships. A bilateral fracture may produce contact of the posterior ridges and extreme posterior displacement of the mandible to a degree that may cause respiratory embarrassment.

The degree of trismus which results from condylar fractures varies greatly. In some cases, fragment displacement may produce a blocking of mandibular excursion which persists until the condylar head is reduced to an unobstructive position.

Hemorrhage from the external auditory meatus may complicate a posterior displacement of the condylar head accompanied by impaction and comminution of the tympanic plate. This condition is to be distinguished from bleeding from the ear in basal and other skull fractures.

TREATMENT

Treatment planning of condylar fractures must be based upon essential diagnostic facts. Accurate roentgenographic evidence showing the fracture

Fig. 12.—Bilateral condylar fractures with medial dislocation of left fragment and medial displacement of right fragment.

line and the positions and relations of fragments is important to the study of the confronting problem. Condition of dentition, disturbance of occlusion and dysfunction of the mandible during excursions are prime considerations for treatment planning. Since condylar fractures are commonly associated with other mandibular fractures, combined evaluation and management are often necessary. The aims of treatment in all mandibular fractures are the restoration of normal function with correct occlusion, or interarch relations if the patient is edentulous, and the elimination of the associated deformity. Simplicity in early reduction and immobilization is the keynote in satisfactory management. Those procedures are most sound which attain these results directly without increasing the possibility of complications.

Much has been written in recent years regarding the indications and contraindications for open and closed reduction in fractures of the condyle. The two technical approaches will be described briefly before their underlying differences in concept are discussed.

CLOSED REDUCTION

The closed reduction and immobilization procedure has many modifications which are required by specific condylar fracture problems. If there is

Fig. 13.—Anterior dislocation.

little or no displacement and relatively free movement of the mandible, early immobilization by some form of intermaxillary fixation for three to five weeks is advocated. When displacement or dislocation is evident, an attempt at reducing the condylar fragment is indicated before immobilization. This is particularly important if excursions of the mandible are blocked by the malposed condylar head. Reduction may be attempted by bimanual manipulation extra-orally and intra-orally. If overriding is present, downward traction on the ascending ramus will increase the possibility of return of the condylar fragment to a more normally functioning position. Such manipulative procedures are more efficacious if general anesthesia is administered to the patient, because displacing forces are released by complete muscular relaxation. When there is marked overriding of fragments, resulting in an anterior open bite, the posttrauma muscle spasm may be overcome gradually by anterior intermaxillary elastic traction. With this procedure the posterior opposing teeth act as a fulcrum, while the anterior bite is closed, and normal space is restored for the overriding fragments. This principle is employed in the use of posterior bite

Fig. 14.—Severely comminuted condylar fracture.

plates, blocks and appliances in edentulous posterior areas in order to increase the fulcrum-like action. With the relaxation of masticator muscles and restoration of adequate joint space, the condylar fragment may be reduced to a more normal position. The goal of manipulative procedures in such cases is not an accurate anatomic coaptation of fragments but an approximate alinement which does not inhibit mandibular excursions.

Type of immobilization and period of fixation are variable phases of conservative treatment. After manipulative reduction, and assurance that mandibular excursion is not blocked by condylar displacement, some form of fixation may be applied. Among the appliances used for intermaxillary fixation are: direct interdental wire ligation; Stout, Risdon or other wire lug-forming devices; buttons; arch wires; or splints provided with lugs for intermaxillary elastic traction. All types are applicable and have indication in specific cases. Care must be exercised to minimize irritation to soft tissues and to prevent unbalanced displacing forces on teeth. The most satisfactory appliance is that which distributes the forces of traction evenly over the supporting dentition with the least damage to periodontal structures. It is generally agreed that fixation should be applied as soon as possible after manipulation of the mandible has restored normal closed occlusion. Closed fixation may be delayed temporarily from twenty-four to

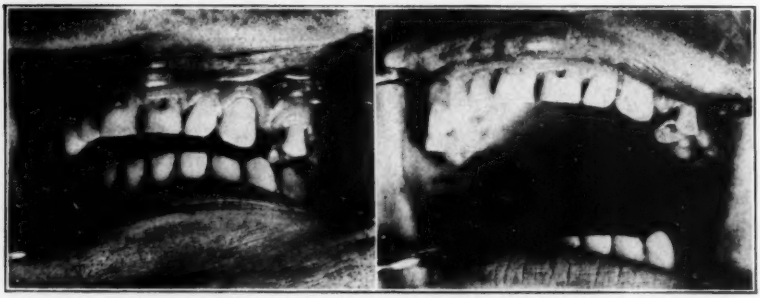


Fig. 15.—Left: Bite abnormality in unilateral fracture with jaws closed. Right: Shortening of interarch distance on the affected side with jaws open.

forty-eight hours while intermaxillary elastic traction produces the desired reduction. Incomplete fixation has been advocated by those who contend that fragment mobility will prevent threatened ankylosis. Early limited excursions are encouraged in order to establish a flail joint or pseudoarthrosis. According to this concept, an adaptive balance of masticator muscles permits adequate functional excursions in such a condition. This principle is used by some British authorities as their preferred treatment for unilateral condylar fractures. Cap splints which embrace training flanges are frequently cemented to the teeth for guidance of the mobile mandible to proper occlusion.

The management of bilateral fractures of the condyle does not differ significantly. Since typical posterior displacement of the mandible and anterior open bite are often extensive, early and complete reduction and immobilization are advantageous in preventing serious deformity. Sometimes anterior and superior traction may be applied by intermaxillary elastics. When reduction is complete, immobilization is established and maintained for the desired period. The period and degree of fixation will vary with the case and with the viewpoint of those in charge.

Intracapsular fracture of the condylar head is relatively rare and difficult to demonstrate. Some authorities have designated intracapsular fractures involving articular joint surfaces as those most vulnerable to ankylotic complication. Treatment by conservative methods is essentially the same as that in other condylar fractures.

Since fractures of the condyle are so frequently associated with other mandibular fractures, intermaxillary fixation provides a combined form of treatment. Under these conditions, a compromise must be made between the ideal fixation periods for each fracture. It is considered advisable to continue observation of patients with condylar fracture for four to six weeks after discontinuing fixation. Minor adjustments in articulation of the teeth may be indicated and are readily made by selective grinding.

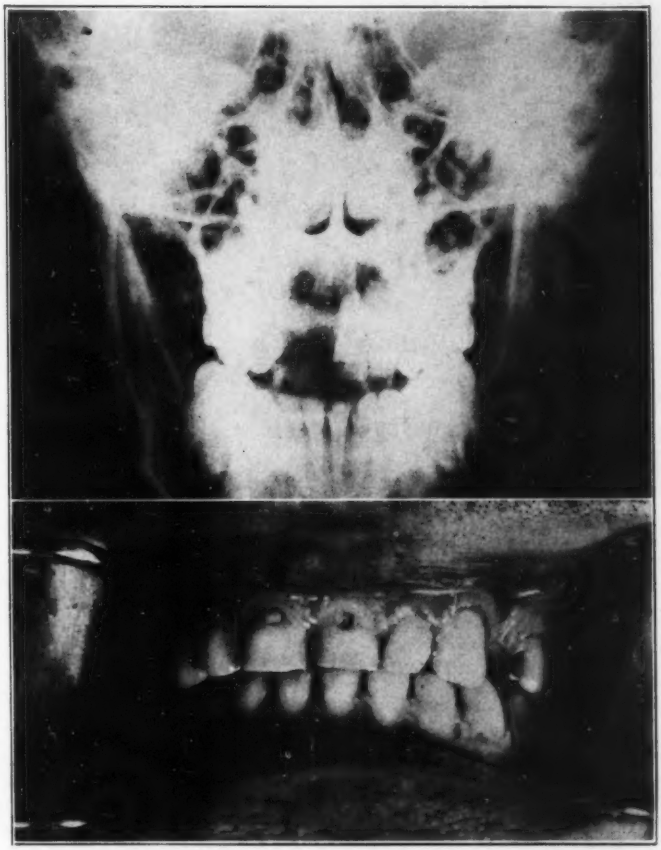


Fig. 16.—Above: Roentgenogram of fracture producing clinical signs seen in Figure 15. Below: Occlusion after treatment.

OPEN REDUCTION

In recent years numerous reports have appeared in the literature, advocating open reduction for fractures of the condyle. The basis for this work stems from the belief that dislocation and appreciable displacement are indications for surgical intervention. The procedure ranges from reduction through a simple intra-oral or extra-oral incision to a complex visual reduction with transosseous wire ligation of fragments in exact anatomic relation. The intra-oral approach, described by Silverman,[1] employs a vertical

1. Silverman, S. L., A New Operation for Displaced Fractures at the Neck of the Mandibular Condyle. *D. Cosmos* 67:876 (September) 1925.

On you were treated at
for fracture of the jaws. In that we are compiling information about such cases, your cooperation will be greatly appreciated. For your convenience, we are enclosing a card which we would like to have checked and returned as soon as possible. Thanking you in advance, I am

Sincerely yours,

DATE.....

NAME..... CASE NO.....

1. Are you able to open and close your mouth normally? Yes....No....
2. Are you having any pain or discomfort when opening and closing the mouth? Yes....No....
3. Will it be possible for you to come for an x-ray examination which will be done without charge? Yes....No....
4. Remarks

Fig. 17.—Form request for information and questionnaire card used for initial contact.

incision of 2 cm. from the tip of the coronoid process inferiorly along the anterior border of the ascending ramus. Soft tissues are reflected from the medial surface, and a urethral sound is inserted to engage the medially displaced fragment and reduce it laterally by lever action. The buccal maxillary tuberosity serves as the point of the fulcrum. When the condylar head is reduced, intermaxillary fixation is applied. A similar manipulative procedure for reduction, described by Thoma,[2] may be performed with a small hook through a short horizontal preauricular incision just inferior to the zygomatic arch.

Significant difficulties are encountered during complete open reduction and fixation. Through a vertical preauricular incision, adequate visibility and exposure are difficult. In a small, deep field one must carry out a difficult technical procedure without damage to such important adjacent structures as the internal maxillary artery, branches of the facial nerve and the temporomandibular joint capsule. Fixation is made laboriously complex with this approach. Wire ligation through holes drilled in the approximated fragments sometimes is considered ideal fixation. In selected cases, external pin fixation has been used to supplement internal wiring. Pins are inserted just below the condylar head and into the temporal zygomatic process.

More radical surgical management employs condylectomy in cases in-

2. Thoma, K. H., Fractures of the Condyle of the Jaw. *Am. J. Orthodont. & Oral Surg.* 31:220 (April) 1945.

Name.....Case Number.....Sex....Age....

1. History of injury including date, direction of force, and date of treatment.

2. Site of condylar fracture. (Indicate on chart No. 1)
3. Position of fractured condyles before treatment. (Indicate on chart No. 2)
4. Treatment—type of immobilization—course—etc.

5. Result—functional and roentgenographic. (Indicate on chart No. 3)
6. Complications.

7. Remarks.

Follow-up Examination Date.....

8. Is information from correspondence.....or clinical examination.....?
9. Function—Normal.....Abnormal.....If latter, describe.
10. Pain or discomfort—No.....Yes.....If latter, describe.
11. Deformity—No.....Yes.....If latter, describe.
12. X-ray findings—(Indicate on chart No. 4)

Chart No. 1	Chart No. 2	Chart No. 3	Chart No. 4

For elaboration of any item, do so by number on opposite side of this sheet.

Fig. 18.—Example of individual case sheets.

volving wide displacement and dislocations. Several unsuccessful attempts at open reduction are reported[2] to have terminated with condylectomy.

All methods of open surgical reduction are combined with some form of intermaxillary fixation. Patients are selected for open reduction when it is felt that they will not respond well to a closed procedure.[2] Advocates of the open procedure emphasize various complications that may arise when the closed method is used. Among the possible complications listed are ankylosis, traumatic arthritis, limited motion and malocclusion. Advocates of open reduction suggest that we are not aware of these complications because clinical cases that have been reported were managed by conservative methods and have not been followed closely for years after treatment.

During the past decade, open reduction has been introduced as an improved treatment for condylar fractures. The underlying concept and

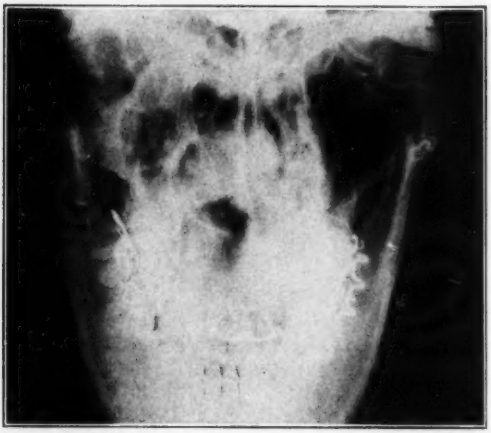


Fig. 19.—Result of an open reduction with direct wiring.

prime objective of open reduction is the restoration of fragments to accurate anatomic position. However, roentgenographic evidence of fragment realinement has little significance as a goal for the treatment of condylar fractures. Ivy,[3] Kazanjian,[4] Berger,[5] Fry[6] and many others have stressed the fact that without realinement of fragments condylar fractures under conservative treatment attain very satisfactory functional results. Open operation has not been employed widely for many reasons. There are numerous types of condylar fracture in which open reduction and fixation is a technical impossibility. The procedure invites many complications. The fracture is made compound by the procedure, and additional invasion of and trauma to the joint capsule foster cicatricial processes and ankylosis. Surgical intervention is precarious because of the significant anatomy of the region. Direct wiring and pin fixation induce trauma and introduce foreign material, thus promoting the pitfalls of infection and necrosis.

COMPLICATIONS

The significant complication of fractures of the mandibular condyle is altered function. Such a disturbance may vary in degree from an asymptomatic limitation of a lateral excursion to possible ankylosis. Thoma[7] has

3. Ivy, R. H. and Curtis, L., Further Observations on Fractures of the Mandible. *D. Cosmos* 71:341 (April) 1929.

4. Kazanjian, V. H. and Strock, M. S., Early Treatment of Fractures of the Mandible. *J.A.D.A.* 29:76 (January) 1942.

5. Berger, A., Fractures of the Mandibular Condyle. *J.A.D.A.* 30:819 (June 1) 1943.

6. Fry, W. K., Shepherd, P. R., McLeod, A. C. and Parfitt, G. J., *Maxillo-Facial Injuries*. London: Blackwell, 1942.

7. Thoma, K. H., Functional Disturbances Following Fracture of the Mandibular Condyle and Their Treatment. *Am. J. Orthodont. & Oral Surg.* 31:575 (October) 1945.

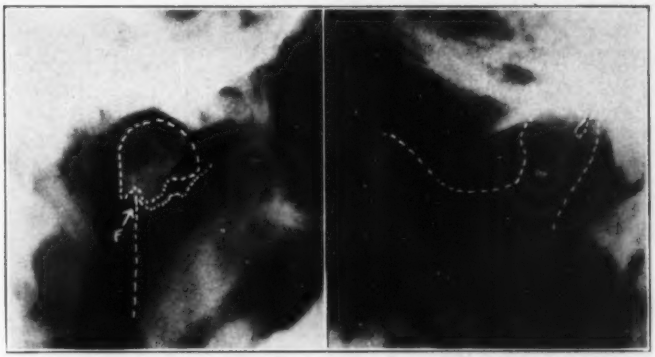


Fig. 20.—Crushing fractures of condylar heads.

Fig. 21.—Intracapsular fracture splitting the condylar head.

reported cases of partial ankylosis resulting from malunion of a displaced condylar head and from an insufficiently fibrous pseudoarthrosis. Another possible complication is pain from traumatic arthritis of the adjacent temporomandibular joint. Bellinger[8] has reported a rare complication of condylar fracture with sequestration of the dislocated fragment. Although these major complications are very significant in considering several isolated cases of condylar fracture, their incidence should not be magnified to a point where they are expected as concurrent developments.

Since the mandibular condyle is a site of endochondral bone formation for the first sixteen to twenty-one years of life, it has been suggested that

8. Bellinger, D. H. and Henny, F. A., Fracture of Mandibular Condyle Complicated by Sequestration. *Am. J. Orthodont. & Oral Surg.* 27:281 (May) 1941.

Fig. 22.—Extreme medial dislocation of fractured condyle. Above: Appearance at time of injury. Below: Healed position six years later. There was slight asymptomatic deviation to the affected side upon opening. Function was good and otherwise normal. The patient was treated conservatively with arch wires and intermaxillary fixation for six weeks.

condylar fractures in children may disturb development of the ascending ramus. There are no reported studies on this hypothesis. However, the same epiphyseal growth has been thought to aid in readjustments of function and growth after condylar fractures. Intracapsular fractures in children are considered by some writers to hold great potentialities for ankylosis.

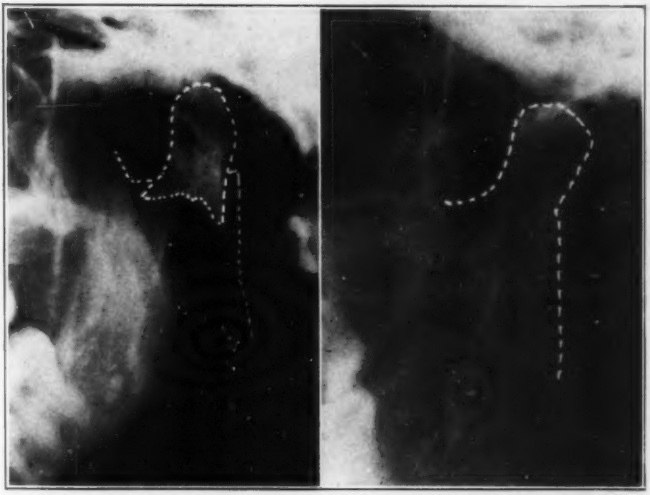


Fig. 23.—Left: Fractured condyle in a patient aged 33, treated by intermaxillary fixation for four weeks. Right: Healed appearance seven years later. Follow-up examination revealed normal function, no limitation of excursions and no discomfort of any kind.

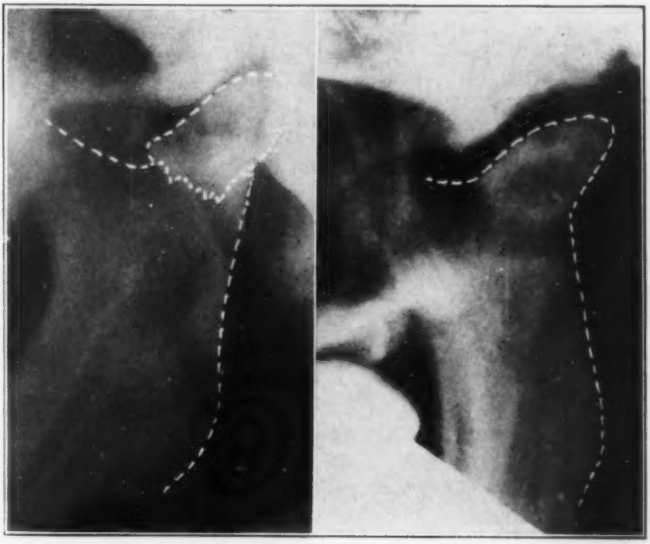


Fig. 24.—Left: Condylar fracture in a patient aged 40, treated by intermaxillary fixation for four weeks. Right: Healed position eight years after treatment. Upon follow-up examination, function was found to be excellent and the patient was without complaints.

Analysis of 120 Cases Followed Up After Condylar Fractures

General Statistics

Total number of cases	120	
Male	70	
Female	50	
Average age of patient	28	years
Youngest patient	4	years
Oldest patient	68	years
Site of fracture		
Condylar neck		
Unilateral right	29	
Unilateral left	52	
Bilateral	36	
Intracapsular	3	
Position of condylar fragment		
No displacement	30	
Displacement		
Anteromedial	39	
Anterolateral	12	
Posterior	5	
Dislocation		
Anteromedial	14	
Posterior	6	
Lateral	1	
No available x-ray evidence for location	6	
Associated mandibular fractures		
None	39	
Single	63	
Multiple	18	

Chart 1

CHALMERS J. LYONS CLUB SURVEY

In order to help clarify the principles of condylar fracture management, the Lyons Oral Surgery Group organized a comprehensive study of cases that were followed. Some patients included in the series were treated in hospital clinics and others in private oral surgery practices. Data for the survey were obtained from detailed clinical examination and correspondence. Initial contact was made by a form request for information and by a questionnaire card (Fig. 17).

Case histories of those who responded were carefully reviewed and significant data were recorded on individual case sheets (Fig. 18). In most cases followed by examination it was possible to compare roentgenograms of fractured and healed fragments. A summary of the compiled statistics appears on the following survey charts (Charts 1 and 2).

The data shown in Chart 1 require little comment. We are unable to account for the higher frequency of left condylar fracture on either an anatomic or an etiologic basis. Bilateral measurements of condylar necks

Analysis of 120 Cases Followed Up After Condylar Fractures

Treatment of Cases Followed Up

Treatment	
Intermaxillary fixation, closed reduction	108
General anesthesia during reduction	10
Average period of intermaxillary fixation	5 weeks
Soft diet and observation only	10
Open reduction with direct wire fixation	0
Open operation to position dislocated head	2
Survey of cases followed up	
Clinical examination	60
Correspondence	60
Average interval between treatment and follow-up survey	5 years
Shortest interval between treatment and follow-up survey	8 months
Longest interval between treatment and follow-up survey	19 years
Complications	
Ankylosis	0
Deformity	0
Functional disturbance of any type	7*

*See discussion.

Chart 2

on a series of dry specimens revealed no appreciable or constant variations. Reviews of the histories showed auto accidents, falls and blows to be the most common causative factors. Fragment displacement with dislocation was, expectedly, most common anteromedially in the direction of external pterygoid pull.

The treatment and statistics of cases followed up, shown in Chart 2, demand further explanation. Closed reduction was employed in almost all cases. Although general anesthesia was used in relatively few cases, it is considered advantageous for better reduction, and reportedly decreases minor occlusal disturbances after treatment.

Varied types of intermaxillary fixation were employed. No bite blocks or plates were utilized during treatment in this series. For one patient with bilateral condylar fracture and extreme posterior displacement of the mandible and associated structures, it was necessary to use anterior traction with a headcap to maintain an airway. The five-week average period of fixation is misleading, since this includes treatment of associated fractures as well. When there were no associated fractures, the average period of immobilization was three weeks. In the management of some patients, a degree of movement was permitted during the last part of the treatment period. Management by soft diet and observation was found successful for edentulous patients with no displacement and with normal interarch relationship. No specific indications were emphasized for the two supplementary procedures employing surgical reduction and no complications were reported. Although inability to establish its status by a follow-up examination prevented its inclusion in the series, a case of open reduction was reviewed dur-

Fig. 25.—Bilateral condylar fractures in a patient aged 5.

ing the survey. The operation was described as extremely difficult, and although the fragments were thought to be accurately alined, the roentgenogram taken immediately after operation revealed a discrepancy (Fig. 19). Unfortunately, contact could not be made with the patient for re-examination.

The average five-year interval between treatment and follow-up examination indisputably provided ample time for complication. Several complaints received on correspondence cards required evaluation at examination. Two patients had symptoms of pain in the anterior maxilla from an associated depressed malar fracture. Another patient, reporting pain during chewing, was found at examination to have merely grossly carious teeth and no pain or disturbance in the condylar region. Of the seven functional disturbances reported, three were found to be asymptomatic limitation of lateral excursion to one side. The other excursions were functionally normal. Two patients were found to have deviation to the affected side when the mouth was opened. One patient whose fractures had been bilateral, and who later had dentures constructed, was told by his dentist that the interarch relation was out of line. The denture prosthesis adequately compensated for the discrepancy. A patient with unilateral fracture and with perfectly normal posttreatment function complained of cracking of the joint on the fractured side while yawning and singing (symptoms frequently present where there is no history of fracture or trauma).

The findings at follow-up examination in the three cases of intracapsular fracture had little distinguishing significance. In the case of a man, aged 26, who sustained crushing intracapsular fractures of the condylar heads (Fig.

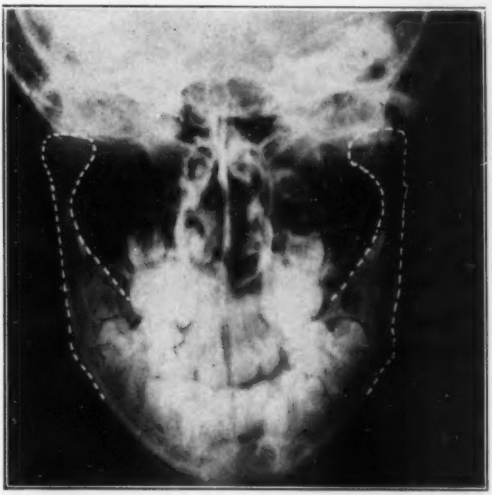


Fig. 26.—Follow-up roentgenogram of same patient five years later, demonstrating complete union.

20), opening at posttreatment examination was limited to two-thirds of normal and eight months passed before complete range of excursion was regained. Perhaps more time is required for adjustment in fractures of the intracapsular type. Apprehension has been expressed by some writers regarding the potentialities for ankylosis of intracapsular fractures in children. The youngest patient in our survey, a girl, aged 4, was involved in an automobile accident and sustained fracture of the mandibular symphysis and a splitting intracapsular fracture of one condylar head (Fig. 21). Stout wiring and intermaxillary elastic fixation for four weeks constituted satisfactory treatment for both fractures. Follow-up clinical examination eight months after treatment revealed no deformity and perfect functional excursions of the mandible.

Although we were unable to obtain adequate history for its inclusion in the present series, one case of ankylosis resulting from postcondylar fracture was found in our Chalmers J. Lyons Club review. The condylar fracture was sustained twelve years before the patient was admitted to the hospital, and the type of fracture and details of treatment were not known. Excursions of the mandible were never normal after treatment and there was gradual progressive limitation of motion over many years until ankylosis was complete. At operation, the condylectomy was made difficult by massive hyperostosis in the region. The postoperative course was uncomplicated, and normal range of mandibular excursion was restored. It is unfortunate that

Fig. 27.—Normal mandibular excursions at follow-up examinations.

Fig. 28.—Normal mandibular development.

specific details regarding injury and original treatment were not available in this interesting illustration of the much-discussed major complication.

Upon a statistical basis, ankylosis would appear to complicate a fractional percentage of condylar fractures. In a recent review[9] of sixty-two cases of ankylosis of the temporomandibular joint, in a large hospital over a thirty-year period, condylar fracture was not found as the cause for a single case. Although trauma was considered to be the cause of approximately 30 per cent of the cases, there were no associated fractures of the mandibular condyle. It is probable that the condylar fracture breaks the stress of the injuring force and reduces the amount of direct trauma to the temporomandibular joint.

Some interesting positions of displaced condylar fragments are demonstrated by comparing original and follow-up roentgenograms of our condylar fracture survey (Figs. 22-24).

9. Jacobson, J. K., Statistical Survey of Temporomandibular Joint Ankylosis. Master's Thesis, University of Michigan, June, 1946.

Fig. 29.—Bilateral condylar fractures with medial displacement.

Although condylar fractures disturb the complex structure of the temporomandibular joint, and theoretically would seem to raise havoc with jaw function, the clinical studies of a large group show complete compensatory functional readjustment in nearly every case.

A condition of special interest regarding disturbance of epiphyseal condylar growth by fracture was found in a boy who sustained bilateral fractures of the condyles at five years of age (Fig. 25). Treatment by manipulative closed reduction and immobilization was administered two days after the injury. Intermaxillary fixation was complete for three weeks and partial fixation was maintained for an additional week. Restoration of function was complete after treatment. Follow-up examination, when the patient was ten years old, revealed complete union (Fig. 26), normal excursions (Fig. 27) and no facial deformity or arrested mandibular development from disturbance of condylar epiphyseal growth (Fig. 28).

A representative case of bilateral condylar fractures and fracture of the symphysis with medial displacement (Fig. 29) afforded special opportunity for observation, since the patient was an intern. Arch bars and intermaxillary elastic fixation were applied two days after injury. Complete immobilization was maintained for four weeks followed by two weeks of partial immobilization. Formal follow-up examination twelve months later

Fig. 30.—Healed fractures (shown in Figure 29) twelve months later.

revealed complete union (Fig. 30), excellent function (Fig. 31) and no deformity or discomfort of any kind.

SUMMARY AND CONCLUSIONS

1. In order to understand the problems of management of condylar fracture, one must appreciate the relations of regional anatomy.

2. Fractures of the condyle have been classified according to the displacement or dislocation of the condylar fragment.

3. Although signs and symptoms are helpful in diagnosis, there is no constant correlation between the manifestation of clinical findings and the extent of fragment displacement as demonstrated roentgenographically.

4. The prime objective of treatment is the restoration of normal function and the elimination of any associated deformity.

5. The aim of treatment is not the roentgenographic evidence of fragment realinement in correct anatomic position. Authorities have emphasized, and results of the survey of cases followed are additional proof, that condylar fractures do well and attain satisfactory function without accurate realinement of fragments.

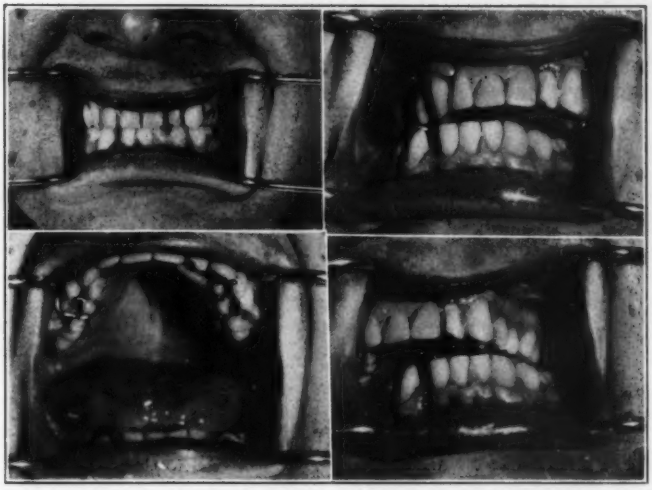


Fig. 31.—Mandibular excursions at follow-up examination.

6. Conservative methods of closed reduction and intermaxillary fixation have a wide range of modification to accommodate individual problems and are a simple and effective approach to the aims of treatment of condylar fracture.

7. Surgical methods in open reduction and direct fixation have defamatory hazards and few indications. The handicaps and complexity of surgical intervention are discouraging. Open procedures introduce additional trauma and invite infection and cicatricial complications.

8. Complications of altered function after condylar fracture are important possibilities, but their incidence and severity should be evaluated in the proper perspective of a large group survey. Major complications were found to be exceedingly rare in our series of 120 cases that were followed. The extreme infrequency of ankylosis as a complication of condylar fractures was made plain by surveys of a large number of condylar fractures and of ankylosis of the temporomandibular joint.

9. In this series of 120 cases a large number of the patients were not skeletally mature but disturbances to epiphyseal growth did not appear. The children who were included in our survey demonstrated no abnormal mandibular development, dysfunction or discomfort when seen at the follow-up examinations.

10. This Chalmers J. Lyons Club survey of cases of condylar fractures that were followed, substantially supports the principle that conservative management yields satisfactory results with minimal difficulties.

OSTEOMYELITIS OF THE MAXILLA: REPORT OF CASE

FRED G. REPASS, D.D.S., M.S.D., Roanoke, Va.

In this case of osteomyelitis of the maxilla, the patient felt that the dentist who had removed the lateral and central teeth was to blame for his condition. Whether osteomyelitis had already begun to develop before the extractions were made or whether injection of the anesthetic solution and the extraction trauma precipitated the osteomyelitis is difficult to surmise. However, reports of Aison,[1] Blair[2] and Waldron[3] showed that a large percentage of cases of osteomyelitis of the jaws are associated with the extraction of teeth during an acute stage of infection or with other surgical trauma, and also with the indiscriminate injection of an anesthetic solution into acutely inflamed and swollen tissues around a tooth.

REPORT OF CASE

History.—A man, aged 49, was referred to me by his dentist on March 1, 1940, because of a persistent pain and swelling in the upper right side of the face after removal of the right maxillary central and lateral incisor teeth under procaine anesthesia, five weeks previously. The patient stated that his face was somewhat swollen when the dentist removed the teeth, that he had a fever and that the teeth were extremely sore.

Examination.—There were numerous fistulous openings in the gingival tissue around the cuspid tooth and extensive swelling and bulging of the maxilla on the right side, extending from the left central tooth to the first

Fig. 1.—Left: Preoperative roentgenogram, showing sequestra. Right: Postoperative roentgenogram.

1. Aison, Emil L., Osteomyelitis of the Jaws. *J.A.D.A.* 25:1261 (August) 1938.
2. Blair, V. P. and Ivy, R. H., *Essentials of Oral Surgery.* St. Louis: C. V. Mosby Company, 1936.
3. Waldron, Carl W., Osteomyelitis of the Jaws. *J. Oral Surg.* 1:318 (October) 1943.

molar. Pus was draining from the sockets of the central and lateral teeth. The patient's temperature was 99.6°, and a blood count showed 85 per cent hemoglobin, 4,400,000 red cells and 12,500 white cells. Reaction to a Wassermann test was negative.

Roentgenographic examination (Fig. 1, left) showed extensive osteomyelitis of the right maxilla, extending from the maxillary left central incisor tooth to the maxillary right second bicuspid tooth.

Operation.—The patient was anesthetized with nitrous oxide and oxygen, an extensive intra-oral incision was made in the region and drains were inserted.

Course.—The region was irrigated daily with warm physiologic saline solution and kept well drained with iodoform gauze.

Second Operation.—When the sequestra had loosened completely, the region was widely opened under block anesthesia and four large sequestra were removed. One large piece was attached to the cuspid tooth (Fig. 1, right). Daily irrigations were continued and then given on alternate days until healing occurred.—*501 Medical Arts Building.*

SALIVARY CALCULUS IN WHARTON'S DUCT: REPORT OF CASE

FRED G. REPASS, D.D.S., M.S.D., Roanoke, Va.

Of all conditions affecting the salivary glands, exclusive of epidemic parotitis (mumps), calculus is perhaps the most common. According to all reports, the submaxillary gland or duct is most frequently affected; the parotid gland assumes second place in this regard and the sublingual gland is least affected of all. During the past fifteen years, Ivy and Curtis[1,2] have reported a total of 115 cases of salivary calculus, 106 affecting the submaxillary gland or duct or both and 9 affecting the parotid gland. Harrison,[3] in 1936, reported a series of twenty-seven cases of salivary calculi, and New and Harper,[4] in 1931, reported seventy cases.

A degree of doubt exists as to the precise cause of formation of salivary calculus. However, most investigators agree or advance the theory that the stone results from the deposition of salts upon small foreign bodies or bacteria which have found their way into the duct. The chemical analysis and bacteriologic examination of tartar on the teeth show a composition almost

1. Ivy, R. H. and Curtis, L., Salivary Calculi. *Ann. Surg.* 96:979 (December) 1932.
2. Ivy, R. H. and Curtis, L., Salivary Calculi. *Internat. J. Orthodontia* 22:179 (March) 1936.
3. Harrison, G. R., Calculi of the Salivary Glands and Ducts. *Surg., Gynec. & Obst.* 43:431 (October) 1926.
4. New, G. B. and Harper, F. R., Chronic Inflammation of Salivary Glands With or Without Calculi. *Surg., Gynec. & Obst.* 53:456 (October) 1931.

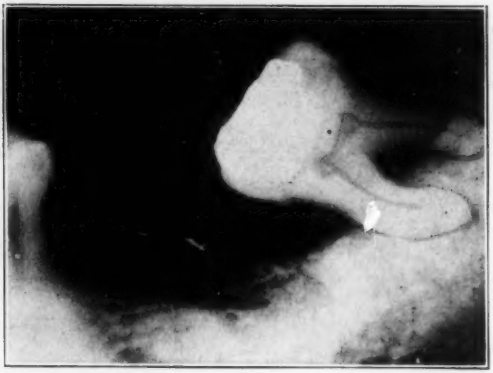


Fig. 1.—Roentgenogram of a molar tooth, showing advanced periodontal disease, suspected as the cause of pain and swelling in the floor of the mouth.

identical with that of salivary calculi. The mineral salts found in salivary calculus are: (1) calcium phosphate, (2) calcium fluoride, (3) calcium carbonate, (4) sodium and potassium chloride, (5) magnesium phosphate and (6) a small amount of potassium thiocyanate.

It is important that a differential diagnosis be made between lymphadenitis, cellulitis and salivary calculus. Many patients have been mistakenly operated on for lymphadenitis or cellulitis, the surgeon believing the condition to be caused by infected teeth or tonsils, when a preoperative diagnosis should have shown an obstruction in a duct. Frequently, the patient will consult a dentist, thinking the trouble is of dental origin, as happened in the case to be reported.

In inflammatory obstruction of Wharton's duct by calculus, little difficulty should be encountered in making a correct diagnosis. There will be an acute or subacute swelling in the submaxillary region, well circumscribed, tender to pressure and usually not adherent to the overlying tissue. There may be sharp pain in the floor of the mouth, radiating along the side of the tongue, more severe during mastication and deglutition. This pain may be stimulated by even the memory of good food or by the sight of food, causing an increase of pressure within the gland during the time of stimulation. Such pain is described as salivary colic. Swelling in the floor of the mouth, associated with a hard mass in the submaxillary region giving rise to a spasmodic pain, more severe during the intake of food, is most important in the diagnosis of obstruction of the submaxillary duct. Roentgenographic examination is of utmost value in confirming the diagnosis. The calculi are rich in mineral salts, making it possible to obtain a good shadow on the roentgenogram in the majority of cases.

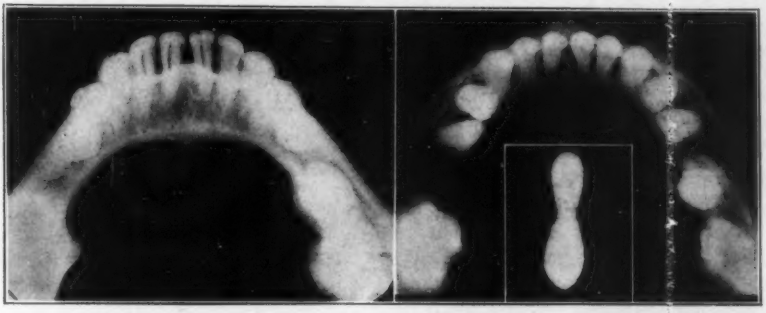


Fig. 2.—Left: Preoperative roentgenogram, showing a dumbbell-shaped calculus. Right: Postoperative roentgenogram. Inset: The calculus.

REPORT OF CASE

A white man, aged 35, complained of pain and swelling below the angle of the jaw on the right side.

History.—The patient had consulted his dentist the day that I first saw him, thinking that his condition was caused by a "sore and loose wisdom tooth" (Fig. 1). He had experienced a somewhat similar but less severe attack about a year before. It had subsided and the patient had not consulted a physician. His present illness had begun about five days before I saw him and had been growing progressively worse. The swelling appeared to increase, and produced pain during mastication.

Examination.—A hard swelling which was not very painful to pressure was palpable in the right submaxillary region. The temperature was 100.2° F. Intra-orally, there was some swelling along the right side of the floor of the mouth and a highly inflamed mucous membrane. A hard nodular mass was evident to the finger, on palpating along the submaxillary duct, and a yellowish-green discharge of pus exuded from the orifice of Wharton's duct.

On roentgenographic examination, a dumbbell-shaped calculus was demonstrated in the anterior two-thirds of Wharton's duct (Fig. 2, left).

Operation.—The patient was given premedication of 1½ grains of Nembutal, as he was highly nervous and apprehensive. The lingual nerve was blocked and a suture was run distal to the nodule, underneath Wharton's duct. This aided in elevating the duct and mucous membrane and prevented any tendency for the stone to slide distally within the duct while the incision was being made. The mucous membrane was incised in the direction of the duct. At incision, a large amount of suppurative material exuded and the anterior bulbous portion of the stone was visible. The stone was grasped with tissue pliers and removed from the duct (Fig. 2, inset). The wound was irrigated with warm saline solution and closed with two silk sutures. Because of the suppuration, a small drain of iodoform gauze was inserted.

Outcome.—The patient experienced only a moderate reaction from the operation. The swelling and pain had practically disappeared on the third day. Further recovery was uneventful.—*501 Medical Arts Building.*

ADAMANTINOMA (AMELOBLASTOMA) OF THE MANDIBLE

RALPH G. PETERSON, D.D.S., Minneapolis

History.—A white man, aged 55, was first seen on January 18, 1941, with enlargement of both sides of the mandible. He had not been aware of the growth until his dentist called his attention to the condition.

Physical Examination.—There was an enlargement along the right and left buccal and labial aspects, and along the left lingual aspect of the mandible. It extended from the region of the right second bicuspid forward through the symphysis and continued back through the left side to just beyond the second molar. The lingual surface of the right side was normal in contour but there was a slight distention along the left lingual surface from the second molar up to and including the left lateral incisor region. The patient had not experienced any symptoms of pain or numbness. All teeth were present in the lower jaw except the left third molar and the right molars. The left first and second molars and the right first and second bicuspids were vital. The others were non-vital.

Roentgenographic Examination.—Roentgenograms revealed a destruction of bone caused by a new growth extending from the left second molar area around through the symphysis and to the second bicuspid on the right side (Fig. 1).

Preoperative Treatment.—The patient was given a prophylactic treatment for his teeth on January 21, 1941. A mouth wash of dilute hydrogen peroxide was prescribed for daily routine use to treat a mild gingivitis that existed in the mouth. He was admitted to the hospital on January 23, 1941.

Operation.—A tumor of the mandible was excised on January 24, 1941, under procaine anesthesia.

All teeth in the mandible were removed except the lower right first and second bicuspids. The mucous membrane on the buccal and labial surfaces was elevated and the bone overlying the tumor was removed. The tumor was then thoroughly removed. The inferior dental nerve on the left side was exposed for more than one inch up to the mental foramen. The entire cavity wall was cauterized with phenol, neutralized with alcohol, and the wound was dressed with half-inch iodoform ribbon gauze saturated with acrithesin ointment.

Biopsy.—The tumor was quite firm and meaty. A specimen was sent to the laboratory where a fast frozen section was prepared and diagnosed as adamantinoma.

Postoperative Treatment.—On January 28, 1941, the dressing was changed and the patient was allowed to go home. Dressings were changed routinely each few days until April 5, 1941, when the cavity became completely lined with epithelium. Healing was uneventful.

Roentgenograms taken seven months later showed a good regeneration of bone (Fig. 2). The patient has been observed each year and there appears

to be no evidence of tumor recurrence. Dental roentgenograms have been taken periodically and show further regeneration of bone and no recurrence of tumor (Fig. 3). The remaining lower right first and the second bicuspid teeth were removed in November 1944, and the patient is now wearing full upper and lower dentures satisfactorily.—*950 Medical Arts Building.*

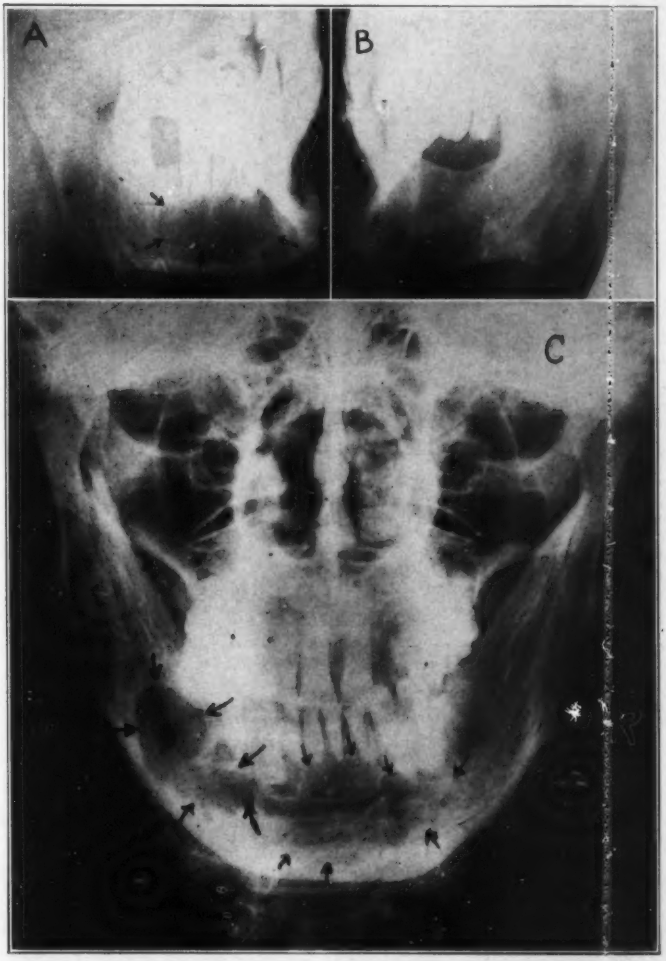


Fig. 1.—Left and right lateral retouched roentgenograms, taken January 18, 1941, showing (A) adamantinoma of the mandible extending distal to the lower left second molar; (B) adamantinoma extending to below the lower right second bicuspid; and (C) postero-anterior view.

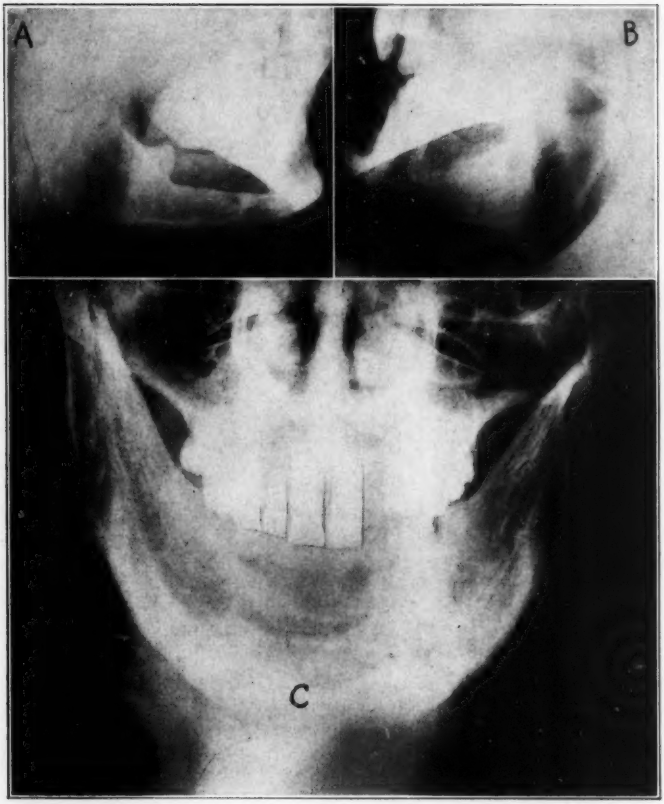


Fig. 2.—(A) Left lateral, (B) right lateral and (C) postero-anterior roentgenograms, taken November 29, 1941, showing regeneration of bone ten months after operation.

Fig. 3.—Left lateral, right lateral and postero-anterior roentgenograms, taken December 8, 1945, showing further regeneration of bone.

DENTIGEROUS CYST OF THE MANDIBLE: REPORT OF CASE

CEDRIC KENNETH DITTMER,* D.D.S., M.D.S., Chicago

The dentigerous cyst is one of several groups of oral tumors arising from the epithelium of the enamel organ. Dentigerous cysts of the mandible, involving unerupted third molars, cuspids and supernumerary teeth are not uncommon. Because these cysts appear to be caused by some kind of irritation or malformation of the developing dental follicle, their growth usually begins in early life. This growth is ordinarily slow and painless; hence cysts frequently attain considerable size before they are discovered.

Robinson[1] differentiates between follicular and dentigerous cysts. The first develops from the tooth germ in the earliest stages and does not contain hard structures of the tooth. The dentigerous cyst develops from the enamel organ after hard substance formation, and therefore contains the crown of a tooth or a tumorous anomaly (odontoma). Both are the result of cystic degeneration of the epithelium. Their cause is unknown. Inflammation may play a part in those cases in which there is cystic degeneration of the follicle of a permanent tooth germ in the presence of an infected deciduous tooth. Kronfeld[2] suggests that, when there is no indication of inflammation as an etiologic factor, the cystic degeneration of the follicle may be the result of a congenital malformation.

The present report deals with a dentigerous cyst involving an impacted left mandibular cuspid. The tooth was situated in a horizontal position at the median line in the symphysis of the mandible, labial to the four incisor teeth which were in normal position. The crown of the tooth extended to the right and the cyst developed in the right side of the jaw. The cyst attained considerable size, extending from the midline posteriorly to the mesial surface of the second molar, but caused only slight displacement of the teeth it involved. It did, however, cause extensive resorption of the roots of those teeth and impairment of their nerve supply (Fig. 1).

REPORT OF CASE

History.—The patient, a white woman, aged 28, was the mother of two children. Her physical condition was unusually good and she gave a history of excellent health with the exception of the usual childhood diseases and a

Read before the Chicago Society of Oral Surgeons, November 30, 1945.

*Department of Oral Surgery, Loyola University, School of Dentistry, Chicago College of Dental Surgery.

1. Robinson, Hamilton B. G., Classification of Cysts of the Jaws. *Am. J. Orthodont. and Oral Surg.* 31:370 (June) 1945.

2. Kronfeld, Rudolf, *Histopathology of the Teeth and Their Surrounding Structures.* Philadelphia: Lea and Febiger, 1939.

Fig. 1.—Upper: Preoperative intra-oral roentgenograms of dentigerous cyst of the mandible, showing defect in bone and resorption of adjacent teeth. Lower: Occlusal views of the same region, showing extent of bone involvement. Note impacted cuspid situated labial to incisor teeth. The anterior margin of the bone defect is at the cervical margin of the cuspid tooth.

tonsillectomy. There was no record of malignancy in her immediate family and no history of an accident or of an injury to her face or jaws.

The patient sought professional advice because the lower right bicuspid teeth had been loose and tender to bite on for a number of weeks. She had also noticed a slight swelling in this region and what she termed a blister on the gums. The patient gave no other history of toothache, pain or swelling.

Clinical Examination.—The contour of the face and the appearance of the skin were normal. Intra-oral examination disclosed a slight swelling on the buccal and lingual surfaces of the right side of the lower jaw in the bicuspid region. The buccal mucous membrane showed a bluish cast in this region. There was no fistula or other evidence of drainage. Absence of the right first molar was noted and there was a slight mesial drift of the second and third molars. The bicuspid and cuspid teeth were in a vertical position but were slightly spaced. Examination of the left side of the jaw revealed a retained deciduous cuspid in the position of the permanent cuspid. The permanent cuspid was missing. All of the teeth in the lower arch appeared to be of uniform color, showing no evidence of pulp necrosis. The general tone and color of the oral tissues were otherwise normal.

Digital examination showed that the tissues of the face and neck were normal. Intra-oral examination revealed a rounded surface or bulging of the buccal and lingual bone plates on the right side of the lower jaw, extending from the cuspid posteriorly to the second molar. The bicuspids were fairly loose and the cuspid showed some movement. All of these teeth, especially

Fig. 2.—Roentgenographic appearance of the same region three and one-half years after operation, showing repair of bone defect and of investing tissues of resorbed teeth.

Fig. 3.—Left: Preoperative extra-oral roentgenogram, showing impacted cuspid, extent of bone involvement and resorption of teeth. Right: Same region, showing repair three and one-half years after operation.

the bicuspids, were tender to percussion. The bulging bone plate on the lingual side was firm on palpation. The buccal bone plate gave no evidence of crepitation on pressure but revealed a defect. In this region there was definite fluctuation with tenderness on palpation. Pressure on the soft tissues or at the gingival margins of the teeth involved produced no exudate. Digital examination of the retained deciduous left cuspid disclosed that it was firmly attached to its base. There was no bulging of the tissues or other evidence that the permanent cuspid was present within the jaw. All other teeth were firm.

Intra-oral, occlusal and extra-oral roentgenograms of the lower jaw were made (Fig. 1 and Fig. 3, left). The examination revealed a fairly oval region of rarefaction in the right side of the jaw, extending posteriorly from the median line to the mesial surface of the right second molar and vertically from the inferior border of the mandible practically to the crest of the ridge in the bicuspid and first molar region. The roots of the two bicuspids were extensively resorbed; the root of the cuspid showed some resorption. Less than 2 mm. of the root of the second bicuspid was embedded in bone. A layer of compact bone was evident along the superior border of the radiolucent area, while the other borders of the region gave a more irregularly punched-out appearance with no compact

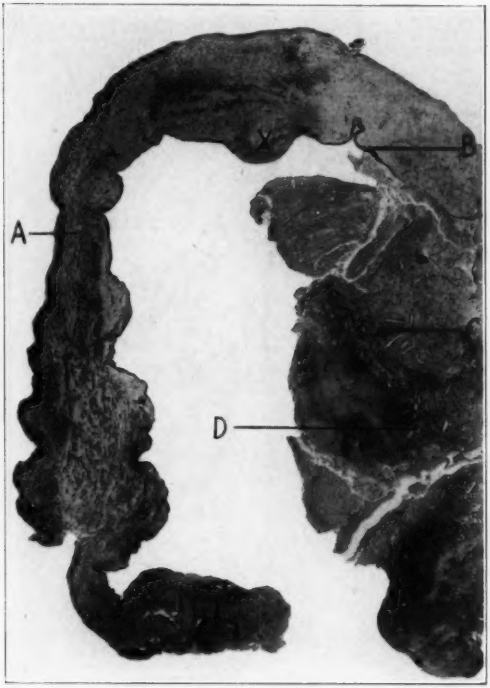


Fig. 4.—Photomicrograph of the cyst wall. Note that the polypous growth (D) has no epithelial lining. It shows granulation tissue and bleedings. The epithelial lining is very thin, owing to growth of granulation tissue, X. (A) Wall of cyst. (B) Epithelial lining of cyst. (C) Cholesterol crystals in granulation tissue. (D) Polyp.

bone evident. At the midline, labial to the incisor teeth and close to the inferior border of the mandible, an impacted tooth was evident. The tooth was in a horizontal position with the coronal portion extending toward the right side of the jaw. The roentgenogram of the left cuspid region disclosed that the permanent cuspid was missing and that the root of the retained deciduous cuspid was resorbed, but the investing hard tissues appeared to be quite normal.

All of the lower teeth were tested for vitality. The right central and lateral incisors, cuspid, and first and second bicuspids did not respond. All other teeth responded normally. There were no symptoms of anesthesia or of paresthesia in the lip or face.

The diseased region was aspirated, and about 10 cc. of fluid was withdrawn. The fluid was more watery than viscid. It was amber colored and slightly cloudy in appearance, but it contained particles that glistened like cholesterol.

Diagnosis.—Diagnosis of a dentigerous cyst was made. This cyst originated from the coronal portion of the impacted mandibular cuspid.

Fig. 5.—High magnification of X region in Figure 4, showing polypoid proliferation of cyst wall. The epithelial lining is very thin (A). The margin of the epithelium (B) consists of four to six cell layers.

Operation.—The patient was placed under local anesthesia and a large elliptical window was cut out of the buccal mucous membrane and the wall of the cyst. There was little bone encountered, and this was removed with rongeurs. The bone cavity was dried and examined, using a mouth lamp. The crown of the impacted cuspid was plainly visible. On examination it was noted that the cystic lining was not firmly attached to the surrounding bone but in some places appeared to be quite free from it. Because of this operative disclosure, removal of the impacted tooth and complete enucleation of the cyst were decided upon. The original plan was to use the open or Partsch method of treatment and to remove the impacted tooth later. Little difficulty was encountered in removing the tooth and in enucleating the cyst wall. The cystic membrane was easily detached from the bone where the teeth were involved and extensive root resorption had taken place. As was stated previously, the teeth from the midline posteriorly to the second molar gave no response to

vitality test, but their color was perfect, they had not been filled and they looked like vital teeth. Because of these facts, the extensively resorbed bicuspid teeth and the cuspid tooth, which was also involved, were not extracted. The cavity in the bone was packed with a gauze dressing saturated with petroleum jelly.

Course.—After the first two dressings had been changed, iodoform gauze was used. Two weeks later, the gauze dressings were dispensed with, and a modeling compound core was constructed. The patient had very little postoperative pain or swelling, and healing was uneventful.

Pathologist's Report.—The tissue that was removed was sent to a pathologist for microscopic examination. His report confirmed the diagnosis. The wall of the cyst consisted mainly of granulation tissue (Fig. 4). The cavity was lined with a stratified squamous epithelium which was interrupted in several areas. At one place, where the epithelium was discontinued, granulation tissue had proliferated into the cystic cavity, forming a polyp-like structure. The granulation tissue showed an abundance of enlarged hyperemic capillaries. Between the fibroblasts, scattered lymphocytes, some plasma cells and macrophages were found. In the outer layers of the wall, adjacent to the bone and teeth, the connective tissue cells formed a more densely arranged layer. In this layer numerous multinucleated giant cells could be seen. It is very probable that they represented osteoclasts that had been active in bone and tooth resorption. The stratified epithelium lining the cyst did not form pegs (Fig. 6). The basal cells were regularly arranged and showed no evidence of mitotic cell division. The layer of prickle cells was comparatively thin, consisting of three or four rows. The surface of the epithelium showed alternate keratosis and parakeratosis. The fact that the epithelium was thin might explain its permeability to blood plasma and thus the continuous increase of fluid in the cyst. The polyp-like structure which projected into the cystic cavity consisted of young granulation tissue (Fig. 7). Clusters of cholesterol crystals were seen in large quantities, surrounded by multinucleated foreign-body giant cells. The presence of cholesterol indicated the disintegration of cells and proteolysis of the fluid contained in the cyst. Remnants of old bleedings were evidenced by the presence of hemosiderin in the granulation tissue.

DISCUSSION

The cause of the displacement of the tooth germ of the left mandibular cuspid from its normal position to a position in the midline of the jaw is unknown. Degeneration of the tooth follicle of the unerupted tooth caused the development of the dentigerous cyst. Expansion of the cyst caused resorption of the roots of the teeth and impairment of the nerve supply to the pulps of the teeth on the right side of the jaw. There was only slight displacement of these teeth owing to the growth of the cyst. Loss of contact between the cuspid and bicuspid teeth and mesial drifting of the second and third molars frequently result from the extraction of the first molar. The first molar had been extracted five years previously because of a pulp exposure. Extensive resorption of the roots of teeth owing to the expansion and pressure of a cyst is not common. Kronfeld[2] stated

Fig. 6.—High magnification of epithelial lining of cyst. (A) Cyst cavity with blood. (B) Loose fibrous connective tissue of cyst wall.

that a benign growth, such as a dentigerous cyst, is more likely to displace teeth than to cause root resorption, whereas malignant tumors, because of their rapid and destructive growth, may produce rapid and extensive resorption of the roots that lie in the direction of their expansion. Pressure upon the connective tissue surrounding the roots stimulates this tissue to osteoclastic activity. This is particularly true of tumors of epithelial origin such as the ameloblastoma and carcinoma. Epithelial tissue has no resorptive properties but merely stimulates, by its growth, the resorptive activity of the connective tissue between the tumor and roots. Zemsky[3] said, "A tooth need not be extracted simply because of the resorption of its root. This holds true of both vital and pulpless teeth. Root resorption is mostly a symptom of disease and is not a cause. An attempt must be made to determine the cause of root resorption and, when this is discovered,

3. Zemsky, J. L., Root Resorption and Its Clinical Significance. *J.A.D.A.* 16:520 (March) 1929.

Fig. 7.—High magnification of granulation tissue with cholesterol crystals. (A) Cholesterol crystals. (B) Giant cell.

to remove it, if possible. Every case of root resorption must be considered individually. This requires observation over a considerable period of time during which notice should be taken of the changes that occur." Kronfeld[2] reported the repaired resorption of a mandibular incisor following the surgical removal of a cystic ameloblastoma. He said, "The resorbed lower surface of the root is covered with reparative deposits of cementum; the periodontal membrane has been regenerated around all of the root; strong fiber bundles run from the newly formed apex to the fundus of the alveolus. Cementum has been deposited in the apical portion of the pulp chamber, and the pulp tissue is vital." He also reported resorption of a mandibular cuspid caused by an osteogenic sarcoma and says that, when the tooth was removed in biopsy, the pulp was found to be vital although more than one-half of the root had been resorbed.

The dentigerous cyst here presented was operated on about three and

one-half years ago. The latest roentgenograms were made in November, 1945 (Fig. 2 and Fig. 3, right). They show that the repair of the cystic cavity and of the investing hard tissues around the resorbed roots is satisfactory. The teeth are firm and functional; they give no discomfort and show no change in color. The five teeth that did not respond to vitality tests on preoperative examination do not respond to tests at present. In spite of this fact, the conclusion seems to be justified that the pulps in these teeth are vital though not sensitive. Thoma[4] states that in radical antrum operations the nerve supply of teeth, and thus their sensitivity, is often impaired owing to the injuring or cutting of the superior alveolar nerves. He says that injury to the nerves does not necessarily cause the pulp to become necrotic if the blood supply remains intact. Meyer[5] established this fact experimentally by operating on a monkey and later examining the teeth microscopically. Dahm[6] examined the teeth of thirty patients after Caldwell-Luc operations and warns that pulps failing to respond to various tests should not be removed, because vitality is not necessarily interfered with when the nerve supply has been temporarily, or even permanently, disturbed. In the case reported, the growing cyst exerted an increasing pressure on the dental nerves and blood vessels. The interference with the arterial circulation caused the establishment of a collateral circulation by way of connections of the dental and gingival arteries. The dental nerves, however, were permanently damaged and degenerated; thus the teeth lost their nerve supply and their sensitivity and do not react to the usual tests. Their blood supply and their vitality, however, were maintained.

SUMMARY

A dentigerous cyst developed in the right side of the mandible, originating from the impacted left cuspid. The histopathologic investigation confirmed the clinical diagnosis. There was only slight drifting of the teeth, but extensive root resorption resulted from the expansion of the cyst. The teeth on the right side of the jaw anterior to the second molar did not respond to tests for vitality.

The presented case was observed three and one-half years after operation. All of the teeth were retained. They still did not respond to vitality tests, but they were firm and functional and gave no discomfort. It is suggested that a collateral circulation maintained the vitality of the resorbed teeth even though they did not respond to tests. Teeth resorbed owing to the growth and expansion of a cyst, in some instances, may be retained in good function.
—*55 East Washington Street.*

4. Thoma, Kurt H., *Oral Pathology*. St. Louis: The C. V. Mosby Company, 1944.

5. Meyer, W., Der Einfluss der radikalen Kieferhöhlenoperation auf die Vitalität der benachbarten Zähne. *Deutsche Zahn., Mund., u. Kieferh.* 2:434, 1935.

6. Dahm, H., Zur Frage der Zahnschädigungen nach Kieferhölenoperationen unter besonderer Berücksichtigung. *Deutsche Zahn., Mund., u. Kieferh.* 3:395, 1936.

TREATMENT OF MICROGNATHIA ASSOCIATED WITH OBSTRUCTION BY A PLASTIC PROCEDURE

1. A series of six cases of micrognathia under two months of age is reported.

2. Each case presented the typical symptoms of intermittent attacks of "tongue swallowing," inspiratory obstruction, sternal retraction, dyspnea and cyanosis.

3. Anatomically speaking, the mental spines at the posterior border of the symphysis of the mandible are the chief bony attachments of the genioglossi muscles and frenulum of the tongue. In micrognathia these points are placed considerably more posteriorly than normal; therefore, the unsupported tongue presumably falls down over the epiglottis except when it is voluntarily held forward by overexertion of its muscles.

4. From the physiological standpoint, although varying in degree for different cases, the obstruction was shown by laryngoscopic examination to be inspiratory, the tongue acting as a ball valve at the epiglottic level.

5. A plastic operative procedure designed anatomically to correct the retroposition of the tongue is described.

6. This procedure was carried out on all six patients.

7. Five, or 83.3 per cent, have had no further symptoms after operation.

8. In one, a premature infant, the operation gave only temporary relief. Death ensued several days later from other causes at a time when no obstruction was present.

9. There was no operative fatality.—*Douglas, in Plastic and Reconstruct. Surg., 1:308, November, 1946.*